JOHANN HEINZL

Oncore Quick Start Guide

POSITION AND
NAVIGATION SYSTEMS
BUSINESS

ONCORE

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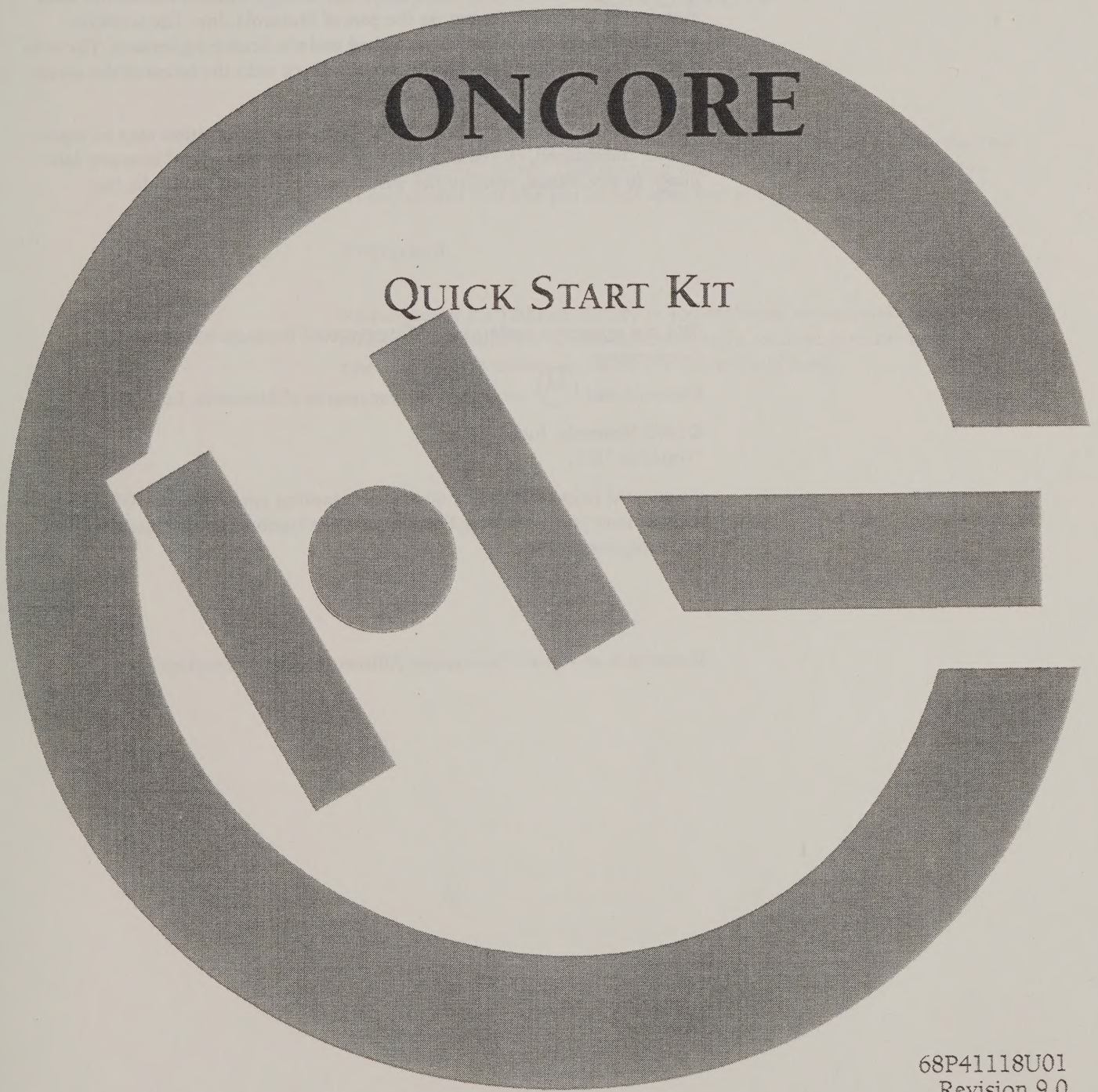
QUICK START KIT



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Revision 9.0
For use with ONCORE Receivers

MOTOROLA

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Lithium Battery Option Users

CAUTION

PRODUCTION UNITS

No electrical connection exists between the Lithium battery and the external applied back-up power. This opening was designed intentionally and it is recommended that this pin be left open and unused.

RECHARGE

Recharging of the Lithium Battery is accomplished automatically while the receiver is powered on. A one-time, overnight recharge is recommended prior to usage to ensure the battery is charged and ready.

Table of Contents

Title	Page
Chapter 1: Overview	1
Active Antenna	2
Passive Antenna	3
Chapter 2: Quick Start	4
Basic ONCORE GPS Evaluation Kit Contents	4
Basic ONCORE GPS Receiver Technical Characteristics	5
Figure 1: Basic ONCORE Receiver Hardware Setup	6
Basic ONCORE Operation Voltage and Current Ranges	8
VP ONCORE GPS Evaluation Kit Contents	10
VP ONCORE GPS Receiver Technical Characteristics	11
Figure 4: VP ONCORE Receiver Hardware Setup	12
VP ONCORE Operation Voltage and Current Ranges	15
System Startup	16
Figure 8: ONCORE Initial Software Setup and Full Cold Start Process Map	18
PC Controller Operating Instructions	21
Description of Most Used Commands	22
Function Key and Screen Display	23
Chapter 3: Description of Receiver Operation	24
Receiver Initialization	24
Signal Strength Parameters	27
Chapter 4: PC Controller Command List Reference	37
Controller and Binary Commands Cross References	38
Command Descriptions	42
Appendix A: Glossary	A1
Appendix B: Engineering Notes	B1
Appendix C: Datum	C1

Chapter 1
Overview

Purpose of Guide

The Quick Start Guide is a road map to guide the operator during setup and operation of the ONCORE Evaluation Kit.

The Quick Start Guide contains:

- Instructions for configuring the ONCORE GPS Receiver - VP and Basic Instructions for Installing and Operating the PC Controller Software
- A PC Controller command section, explaining each receiver command
- Examples of commonly used commands, such as recording data
- Appendices: Glossary, Engineering Notes, Datums

Equipment Description

ONCORE Evaluation Kit Contains

Included are all instructions and equipment necessary to setup and operate the VP or BASIC ONCORE Evaluation Kit, except computer and monitor.

System Description Minimum Requirements

The minimum usable system includes a Motorola GPS receiver, a system controller (such as a personal computer), and a GPS antenna.

ONCORE Receiver Description

Items common to VP and BASIC ONCORE evaluation kits.

A component in a precision navigation system, your GPS receiver is an intelligent GPS sensor. Your receiver can provide autonomous position, velocity and time information over a serial RS-232 port, or TTL output.

Your ONCORE GPS Receiver contains the following:

- Motorola binary
- Differential input/output and RTCM input
- 1 pulse per second output
- Raw data software options
- Configured for use with active GPS antenna
- On board power regulator and RS-232 converter

System Controller Minimum Requirements

The minimum requirements for a system controller are: an IBM compatible 286 computer with DOS 3.1 operating system. Additional computer requirements are:

Component	Minimum Requirement
Clock Speed	8 MHz
RAM	1 Mb
Hard Drive	0.5 Mb available memory
RS-232 Ports	COM1/COM2

GPS Antenna Description and Specifications

The highly selective, low profile antenna has a weather sealed housing with six meters of R58 cable and a RF connector attached.

Active Antenna

The GPS receiver supplies power (+5vdc) to this active antenna.

24 dB amplification; 25 mAmps @ 5 Vdc (max 50 mAmps)

Active and Passive Antenna Information

Active Antenna RF Interface Specifications –V1.5

Amplification:	24 dB
Input impedance:	50
VSWR:	2:1 max at 1575.42 MHz ±1MHz
Connector type:	OSX Jack, Straight
Preamplifier power:	+5V, 25 mA available at connector (max 50 mAmps)
Operating frequency :	1575.42 MHz
Bandwidth:	30 MHz typical
Polarization:	Right hand circular
Pattern :	Essentially Hemispherical
Gain Characteristics:	+3 dBic minimum at 90° above horizon (zenith) 0 dBic minimum at 30° above horizon –6 dBic minimum at 0° above horizon
VSWR:	2:1 max at 1575.42 MHz ±1 MHz into 50 system.
Preamplifier Gain:	18 dB minimum (including 6 dB cable loss)
Noise Figure:	2.5 dB maximum

Passive Antenna

Assuming 0 dB gain levels from the antenna, the acquisition and tracking thresholds for various cable lengths or RG 58 cable (i.e., 1 dB loss per meter) are as follows:

Cable Length	Acquisition Threshold	Tracking Threshold
0 m	–137 dBm	–143 dBm
1 m	–136 dBm	–142 dBm
5 m	–132 dBm	–138 dBm

The acquisition threshold is the minimum signal level of a GPS satellite signal received at the antenna in order for the receiver to acquire and lock onto that signal.

The tracking threshold is the minimum signal level of a GPS satellite signal received at the antenna in order for the receiver to maintain lock (i.e. tracking) once acquisition is achieved.

GPS satellites by design are guaranteed to provide at least –130 dBm level signals on the earth's surface at the end of satellite life. This assumes direct line of sight to the satellite with no interference. In order to allow for a certain margin of attenuation of the signal caused by overhead foliage, etc., a 7 dB margin beyond the –130 dBm was designed into the receiver for acquisition and 13 dB for tracking. As the table above indicates, increasing the cable length narrows these margins due to signal loss along the cable. As the cable length increases, so does the total signal loss along the cable and consequently the tracking thresholds are not as low.

Passive Antenna RF Interface Specifications – V2.5 (recommended)

Connector type:	OSX Jack
Operating frequency:	1575.42 MHz
Bandwidth:	30 MHz typical
Polarization:	Right hand circular
Pattern:	Essentially hemispherical
Gain Characteristics:	+3 dBic minimum at 90° above the horizon (zenith) 0 dBic minimum at 30° above the horizon –6 dBic minimum at 0 (horizon)
Impedance:	50 nominal VSWR 2:1 max at 1575.42±10 MHz

Chapter 2
Quick Start

BASIC ONCORE GPS EVALUATION KIT CONTENTS

The Basic ONCORE Evaluation Kit includes:

1 - 6-channel ONCORE GPS receiver with the following:

- Differential input/output
- 1 pulse per second output
- Raw data software options
- Unit configured for use with active GPS antenna
- On-board power regulator and RS-232 converter (regulator and converter on motherboard for VP ONCORE only)

1 - Active patch antenna with magnetic mount

1 - RG58 coaxial cable (OSX to OSX - Basic ONCORE plastic housing)

1 - Power/data cable

1 - Cigarette lighter to banana plug cables

1 - Cigarette lighter Y adapter

1 - Technical reference manual

1 - MS DOS compatible diskette containing a copy of the PC controller software

1 - Quick Start Kit Guide

BASIC ONCORE GPS RECEIVER TECHNICAL CHARACTERISTICS

General Characteristics	Receiver Architecture	• 6 channel • L1 1575.42 MHz • C/A code (1.023 MHz chip rate) • Code plus carrier tracking (carrier aided tracking)
	Tracking Capability	• 6 simultaneous satellite vehicles
Performance Characteristics	Dynamics	• Velocity: 1000 knots (515 m/s) > 1000 knots at altitudes < 60,000 ft. • Acceleration: 4 g • Jerk: 5 m/s³
	Acquisition Time (Time To First Fix, TTFF)	• 18 sec. typical TTFF (with current almanac, position, time and ephemeris) • 45 sec. typical TTFF (with current almanac, position and time) • 2.5 sec. typical reacquire
	Positioning Accuracy	• Less than 25 meters, SEP (without SA) [DoD may invokeSelective Availability (SA), potentially degrading accuracy to 100 m (2dRMS)] • DGPS accuracy 1–5 meters typical
	Timing Accuracy (1 Pulse Per Second, 1 PPS)	• 130 nanosec. observed (1σ) with SA on • In position hold mode. < 50 nanosec. observed (1σ) with SA on
	Antenna	• Active micro strip patch antenna Module • Powered by Receiver Module (25mA @ 5Vdc)
	Datums	• 49 std. datums, 2 user defined, default WGS-84
Serial Communication	Output Messages	• Latitude, longitude, height, velocity, heading, time, satellite tracking status (Motorola Binary Protocol) • NMEA-0183 Version 2.00 (selected formats) available • Software selectable output rate (Continuous or Poll) • Broad list of command/control messages • RS-232C Interface
Electrical Characteristics	Power Requirements	• 9 to 16 Vdc or 5 Vdc ±0.25 V 50mVp-p ripple (max)
	"Keep-Alive" BATT Power	• 4.75-16 Vdc; 0.3 mA (max) or • 3V on-board battery: 15µA (typ.) 60µA (max)
	Power Consumption	• 1.3 W @ 5 Vdc; 1.8 W @ 12 Vdc
Physical Characteristics	Dimensions	• Receiver Board 3.94 x 2.76 x 0.7 in. (100 x 70 x 17.8 mm) • Plastic Housing 4.13 x 3.03 x 1 in. (105 x 77 x 25.4 mm) • Active Antenna Module 4.01 (dia.) x 0.89 in. (102 (dia.) x 22.6 mm)
	Weight	• Receiver Board 2.3 oz. (64 g) • Receiver in Plastic Housing 3.8 oz. (107 g) • Active Antenna Module 4.8 oz. (136.2 g)
	Connectors	• Data/Power: 10 pin (2x5) shrouded header, RF: OSX (subminiature snap-on)
	Antenna to Receiver Interconnection	• Single coaxial cable (6 dB max loss at L1; 1575, 42 MHz)
Environmental Characteristics	Operating Temperature	• Receiver Module –30°C to +85°C • Active Antenna –40°C to +100°C
	Humidity	• 95% noncondensing +30°C to +60°C
	Altitude	• 60,000 ft. (18 km) > 60,000 ft. (18 km) for velocities < 1000 knots
Miscellaneous	Optional features	• 1 PPS timing output • Raw measurement data • On Board Rechargeable Lithium battery
	DGPS	• Differential GPS-standard software feature • RTCM-104 format (remote input) • Motorola custom format (master output and remote input)

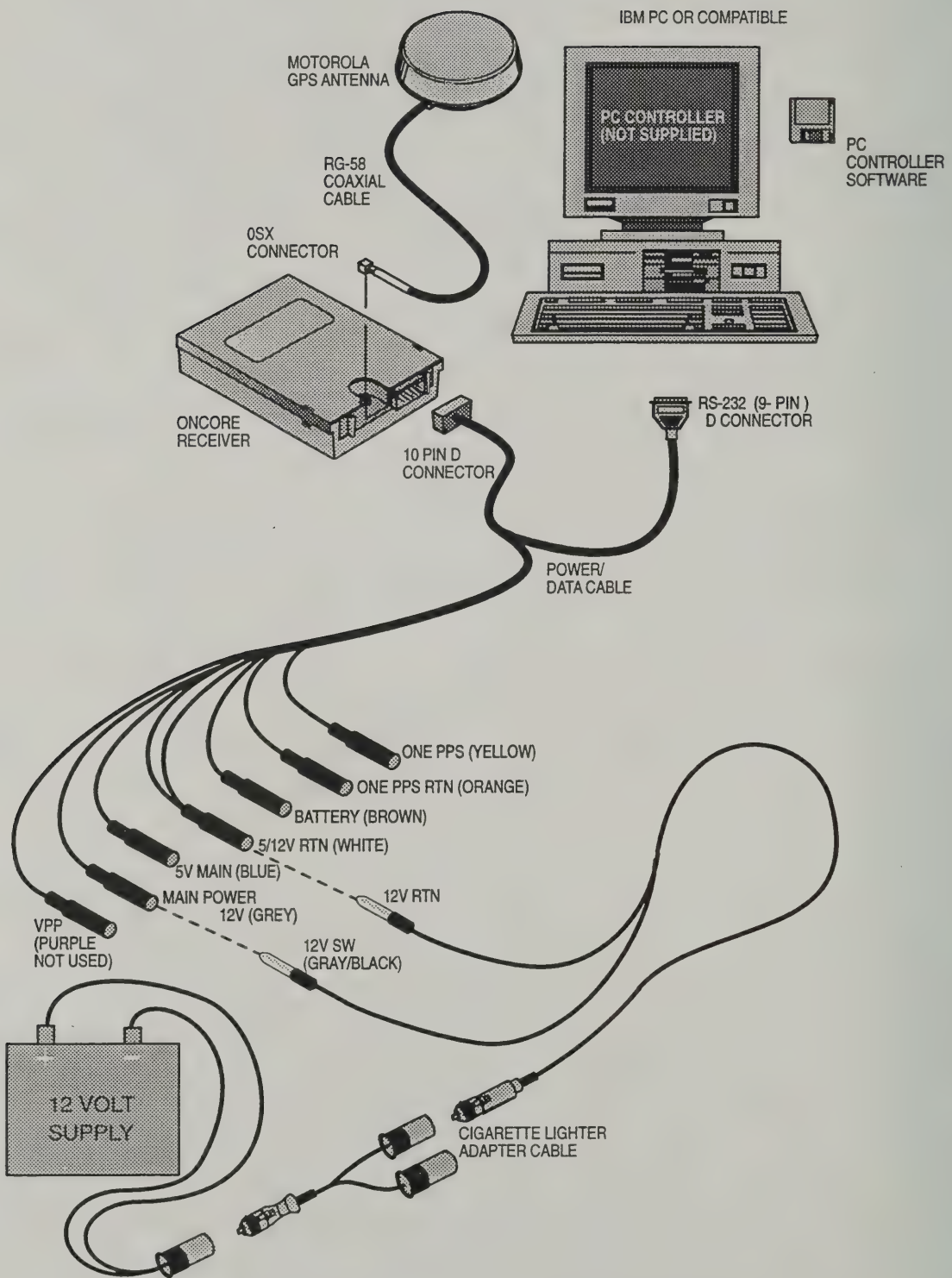


Figure 1: Basic ONCORE Receiver Hardware Setup

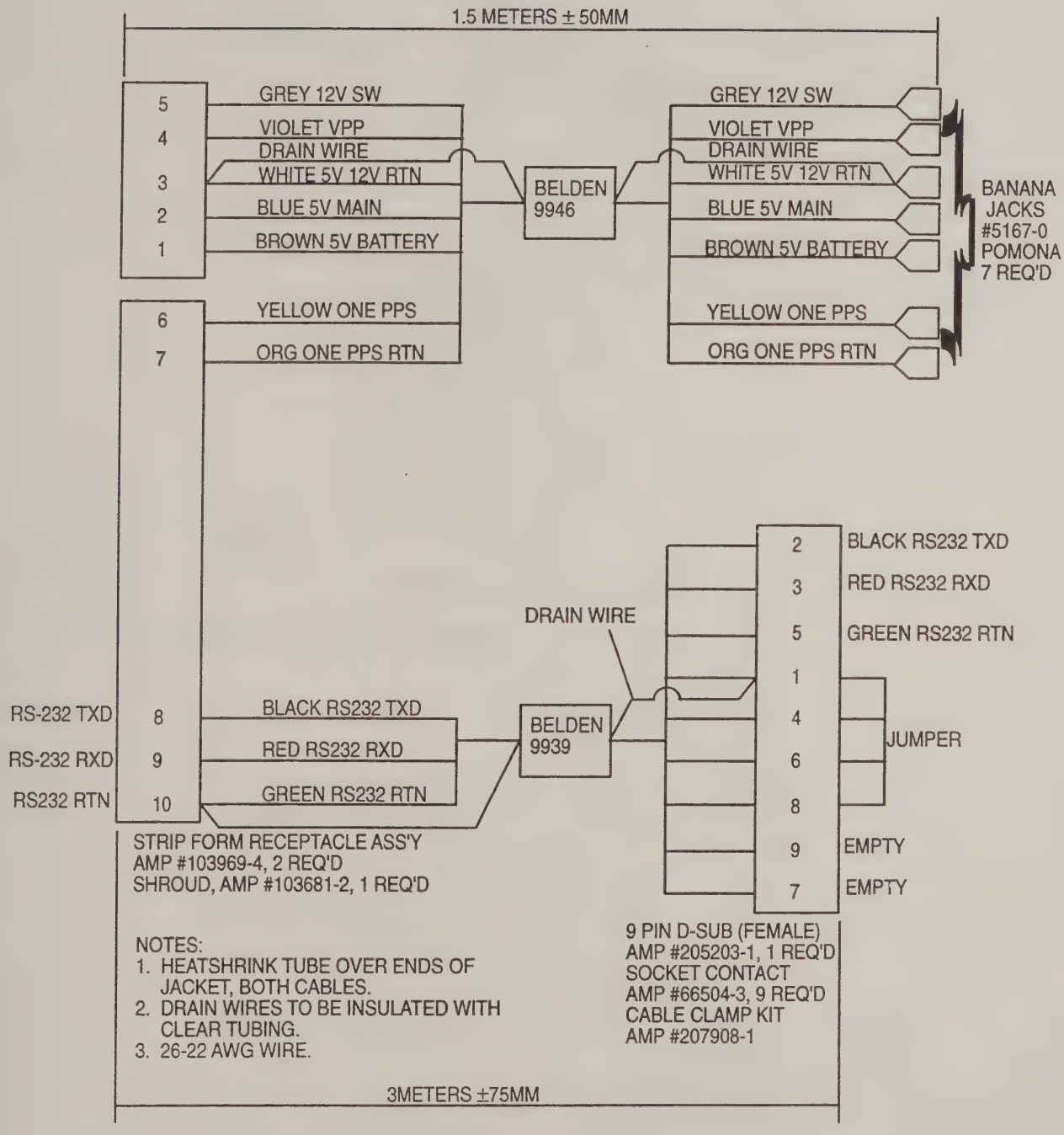
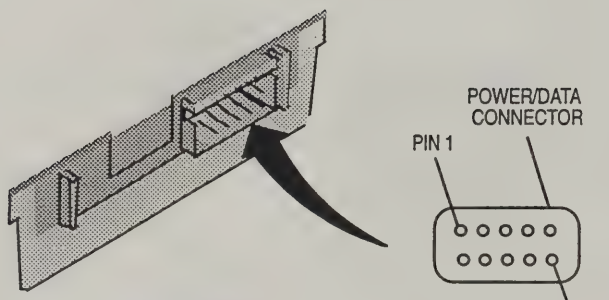


Figure 2: Basic ONCORE Evaluation Kit Power/Data Cable Diagram



POWER/DATA CONNECTOR	
PIN NUMBER	SIGNAL NAME
1	+12V/+5V BATTERY
2	+5V MAIN
3	+12V/+5V RTN
4	VPP
5	+12V MAIN
6	ONE PPS
7	ONE PPS RTN
8	RS-232 TXD
9	RS-232 RXD
10	RS-232 RTN

BASICCON

Figure 3: Basic ONCORE Pin Out Designations

Basic ONCORE Operation Voltage and Current Ranges

12 Vdc PWR (Main power)

Voltage: 9 Vdc to 16 Vdc

Power: 1.8w @ 12 Vdc over temperature range
1.3w @ 5.25 Vdc over temperature range

Current: with Active Antenna
158 mAmps typical @ 12V at 25° C
172 mAmps max @ 12V over temperature range
250 mAmps max @ 5.25V at 25° C

5 Vdc PWR (Main power)

Voltage: 4.5 Vdc to 5.25 Vdc 50 mV peak to peak ripple

Battery

External applied backup power:

Voltage: 4.75V to 16V

Current: 0.140 mAmps typical; 0.3 mAmps max over temperature range

Lithium Battery Option:

Voltage:	3 Vdc
Current:	Typical 5 µAmps @ 25° C 10 µAmps max @ 25° C 60 µAmps max @ 60° C
Battery Life:	90 mAh life between charges At 10 µAmps a fully charged battery will last 3 months without recharging. Full component life: 5+ years
Recharge:	Automatically recharged by main power. Recommended first time charge: 24 hours

VP ONCORE GPS Evaluation Kit Contents

The VP ONCORE Evaluation Kit includes:

1 - 6- or 8- channel ONCORE GPS receiver with the following:

- Differential input/output
- 1 pulse per second output
- Raw data software options
- On-board rechargeable lithium battery
- Unit configured for use with active GPS antenna
- Aluminum housing containing ONCORE printed circuit board, and motherboard
- On-board power regulator and RS-232 converter (regulator and converter on motherboard)

1 - Active patch antenna with magnetic mount
1 - RG58 coaxial cable (OSX to BNC - ONCORE aluminum housing)
1 - Power/data cable
1 - Cigarette lighter to banana plug cables
1 - Cigarette lighter Y adapter
1 - Technical reference manual
1 - MS DOS compatible diskette containing a copy of the PC controller software
1 - Quick Start Kit Guide

Note: The embedded VP ONCORE receiver printed circuit board contains:

- ON Board rechargeable lithium battery
- GPS receiver
- TTL output
- Antenna connector

VP ONCORE GPS Receiver Technical Characteristics

General Characteristics	
Receiver Architecture	• 6 (or 8) channel • L1 1575.42 MHz • C/A code (1.023 MHz chip rate) • Code plus carrier tracking (carrier aided tracking)
Performance Characteristics	
Tracking Capability	• 6 (or 8) simultaneous satellite vehicles
Dynamics	• Velocity: 1000 knots (515 m/s) > 1000 knots at altitudes < 60,000 ft. • Acceleration: 4 g • Jerk: 5 m/s³ • Vibration: 7.7G per Military Standard 810E
Acquisition Time (Time To First Fix, TTFF)	• 20 sec. typical TTFF (with current almanac, position, time and ephemeris) • 45 sec. typical TTFF (with current almanac, position and time) • 2.5 sec. typical reacquire
Positioning Accuracy	• Less than 25 meters, SEP (without SA) [DoD may invoke Selective Availability (SA), potentially degrading accuracy to 100 m (2dRMS)] • DGPS accuracy 1–5 meters typical
Timing Accuracy (1 Pulse Per Second, 1 PPS)	• 130 nanosec. observed (1σ) with SA on • In position hold mode. < 50 nanosec. observed (1σ) with SA on
Antenna	• Active micro strip patch antenna Module • Powered by Receiver Module (25mA @ 5Vdc) • Passive antenna configuration (see optional features)
Datums	• 49 std. datums, 2 user defined, default WGS-84
Serial Communication	
Output Messages	• Latitude, longitude, height, velocity, heading, time, satellite tracking status (Motorola Binary Protocol) • NMEA-0183 Version 2.00 (selected formats) available • Software selectable output rate (Continuous or Poll) • Broad list of command/control messages • TTL Interface
Electrical Characteristics	
Power Requirements	• 5 ±0.25 Vdc 50mVp-p ripple (max)
"Keep-Alive" BATT Power	• External 2.5 V to 5.25 V 15µA (typ.) 60µA (max) • 3V on-board battery: 15µA (typ.) 60µA (max)
Power Consumption	• 1.1 W @ 5 V
Physical Characteristics	
Dimensions	• Receiver 2.00 x 3.25 x 0.64 in. (50.8 x 82.6 x 16.3 mm) • Active Antenna Module 4.01 (dia.) x 0.89 in. (102 (dia.) x 22.6 mm)
Weight	• Receiver 1.8 oz. (51 g) • Active Antenna Module 4.8 oz. (136.2 g)
Connectors	• Data/Power: 10 pin (2x5) unshrouded header on 0.100" centers • RF: right-angle OSX (subminiature snap-on)
Antenna to Receiver Interconnection	• Single coaxial cable (for active antenna –6 dB max loss at L1; 1575, 42 MHz)
Environmental Characteristics	
Operating Temperature	• Receiver Module –30°C to +85°C
Humidity	• 95% noncondensing +30°C to +60°C
Altitude	• 60,000 ft. (18 km) (max) > 60,000 ft. (18 km) for velocities < 1000 knots
Miscellaneous	
Optional features	• 1 PPS timing output • Raw measurement data • On Board Rechargeable Lithium battery • On Board LNA option for use with passive antenna
DGPS	• Differential GPS-standard software feature • RTCM-104 format (remote input) • Motorola custom format (master output and remote input)

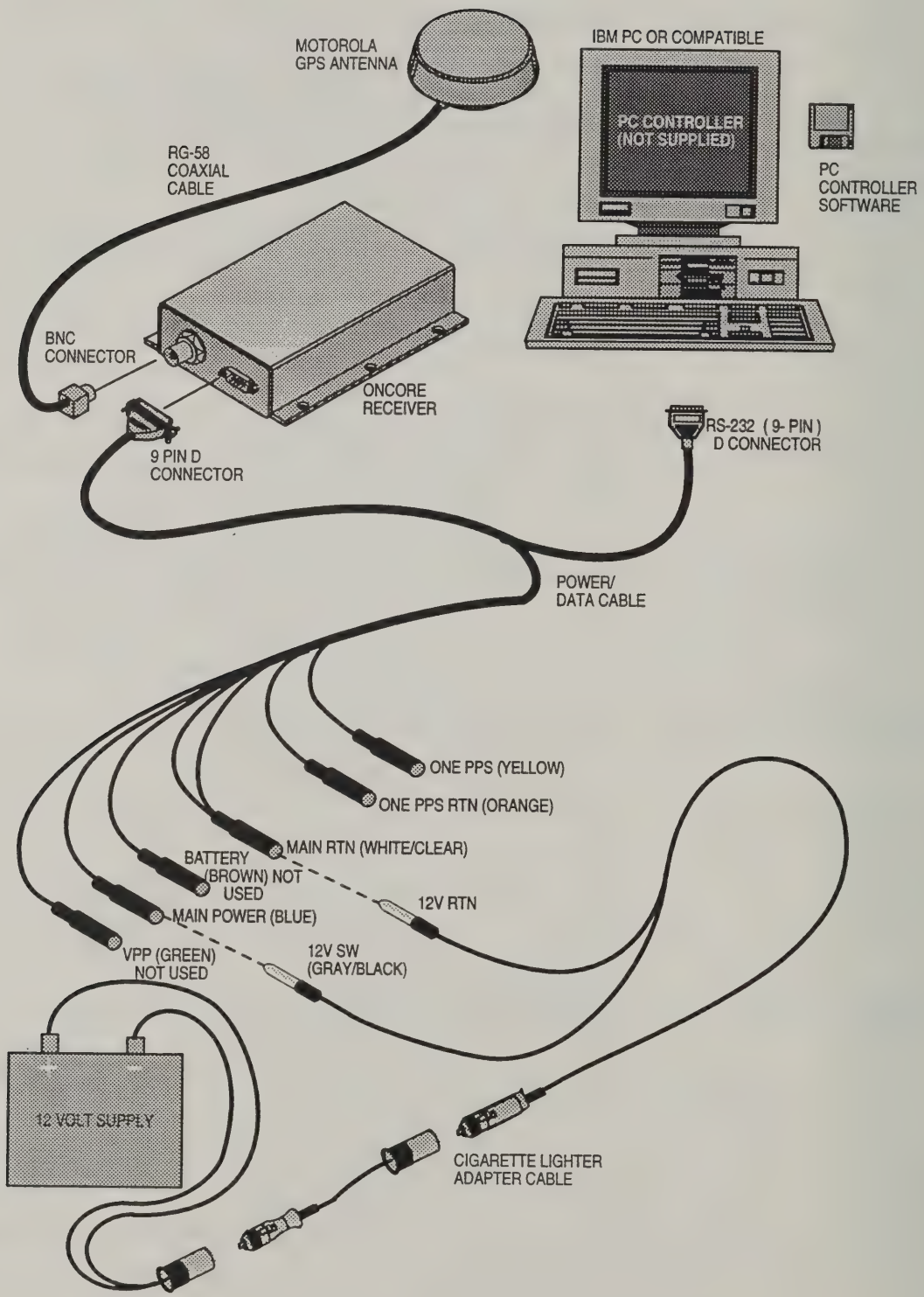


Figure 4: VP ONCORE Receiver Hardware Setup

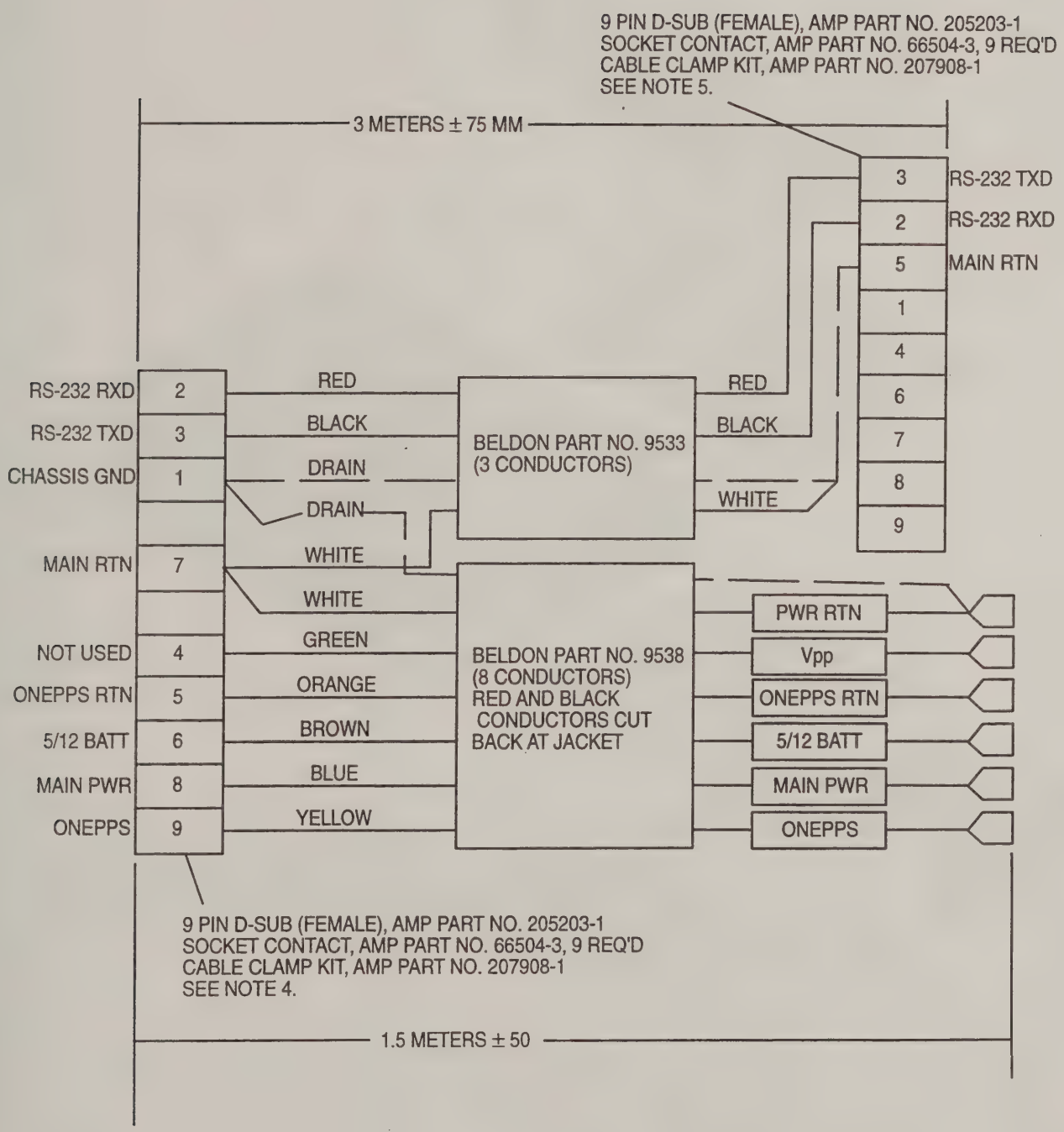


Figure 5: VP ONCORE Evaluation Power/Data Cable

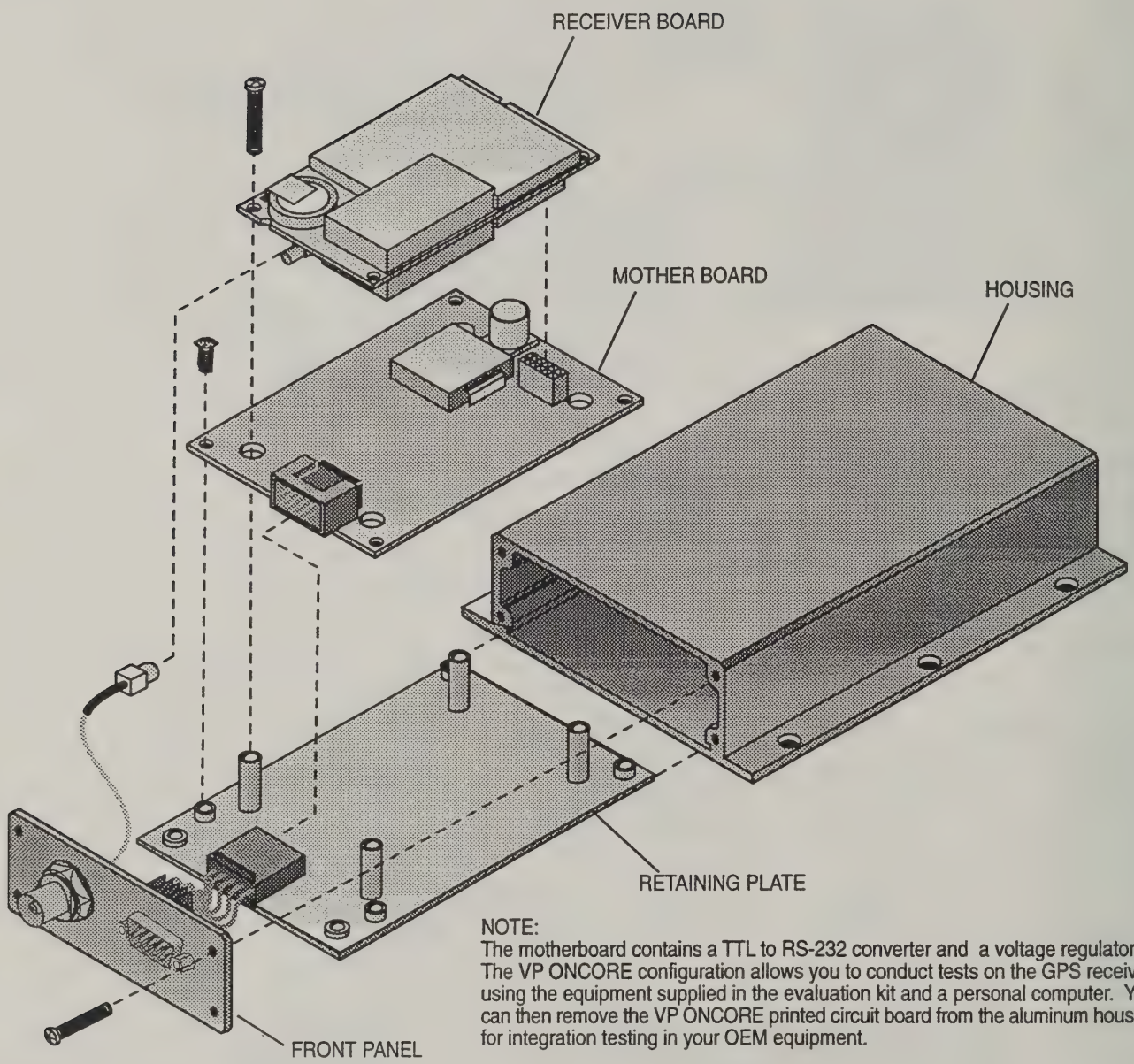
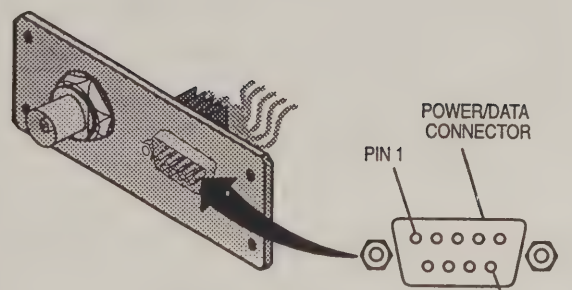


Figure 6: VP ONCORE Exploded View



POWER/DATA CONNECTOR PIN-OUT DETAILS	
PIN NUMBER	SIGNAL NAME
1	SHIELD TO CASE
2	RS-232-RXD
3	RS-232-TXD
4	VPP
5	ONEPPS-RTN
6	5/12V-BAT
7	5/12V-RTN AND RS-232-RTN
8	12V-SW
9	ONEPPS

Figure 7: VP ONCORE Pin Out Designations

VP ONCORE Operation Voltage and Current Ranges

5V PWR (Main power)

NOTE: For VP ONCORE embedded applications only.

Voltage: 4.75 Vdc to 5.25 Vdc
50 mV peak to peak ripple

Current: With active antenna (no LNA option on board):
230 mAmps typical @ 5Vdc at @25° C
275 mAmps max @ 5.25 V over temperature range

With passive antenna (LNA option on board):
215 mAmps @ 5Vdc at 25° C
250 mAmps max @ 5.25Vdc over temperature range

Battery

External applied backup power:
Voltage: 2.5 Vdc to 5.25 Vdc
Current: 15 µAmps typical
60 µAmps max over temperature

Lithium Battery Option:

Voltage:	3 Vdc
Current:	Typical 5 µAmps @ 25° C 10 µAmps max @ 25° C 60 µAmps max @ 60° C
Battery Life:	25 mA life between charges At 10 µAmps a fully charged battery will last 3 months without recharging. Full component life: 5+ years
Recharge:	Automatically recharged by 5 Vdc main power. Recommended first time charge: 24 hours

System Startup

Overview

Before beginning either the initial setup or the full cold start procedure, verify that your computer's system date and time are correct.

Initial Setup

Initial setup procedures connect the computer, antenna and receiver together and initialize the computer and receiver. Steps 1 through 14 of the Action Table below describe the setup of the receiver module, antenna, computer and the loading of the PC Controller Software. Refer to Figure 1 & 4 for the ONCORE Receiver hardware setup and Figure 9 for the Command line and Response line location.

ONCORE Receiver Start Procedure

The Full Cold Start procedure (Steps 1 through 20 of the Action Table below) initializes the receiver for start-up after an extended shut down period; for example, when the stored almanac data is out-of-date, or the receiver has been moved a distance sufficient to make the almanac invalid for the new location. Use the Full Cold Start procedure to configure the receiver for a Full Cold Start Setup.

To configure an ONCORE Receiver with the Full Cold Start Setup, enter the commands exactly as shown in steps 1 through 20. Chapter 4 describes the PC Controller Commands. In the following procedure, the command name is in initial capitals and bold. (**Position Hold Disable**) The typed command is all lower case and bold. (**ph d <ENTER>**) Configure the receiver from a full cold start using Steps 1 through 20 of the following procedures:

1	Connect power and data cable to the serial port of your computer
2	Position GPS antenna on a surface that is level to the horizon and has an unobstructed view of the sky.
3	Connect antenna cable to the connector port on the GPS Receiver module.
4	Power up the computer and wait for the display of the normal prompt.
5	Insert P Controller Software disk into source drive (a: or b:). Make a backup copy of the PC Controller software program supplied with the Quick Start Kit.
6	Select drive. Example: type a: for drive "a."
7	Load the PC Controller Software onto the computer hard drive. Type: **gpsload <source_drive><target_drive>** Example: **gpsload a: c:<ENTER>**

Software Loading: steps 4 through 7

8	After loading, select the computer hard drive and change the directory to **gpsXX** *(insert appropriate version number in place of "XX").* Example: **cd gps90<ENTER>**
9	On the computer , launch the PC controller software program by typing the following command: **gps<ENTER>**
10	Observe the Enter Command line for the following request: **Enter Comm Port (1 / 2) <return>, 1 default, 'q' quit:** If this request does not appear: • Check computer • Reload PC Controller Software
11	At the **6 or 8 Channel receiver? (6/8) <return>, 6 default, 'q' quit** prompt, enter the number of channels of your GPS receiver, or enter 'q' to quit the program.
12	On **Response** line, observe following message. Example: **datum 49 = SMA - 6378137.000 IF - 298.257223563** **dx - 0.0 dy - 0.0 dz 0.0**
13	On **Enter Command** line, change receiver to **Position Idle Mode** command. Type: **mode i<ENTER>**
14	The Initial Software Setup process is complete. Proceed to step 15.
15	On **Enter Command** line, change receiver to **Position Message** command. Select one second interval. Type: **pos 1<ENTER>** (6 channel); or **ps8 1<ENTER>** (8 channel)
16	Press the <F3> key to see if a current almanac is available in RAM. If one is available, proceed to Step 17. Use the (**run command**) Type: **run alm<ENTER>** If no almanac is available, load an almanac from the PC Controller disk. Use the file with **.alm** extension and proceed to Step 17.
17	Make the following entries on the **Enter Command** line. a. Enter local GMT offset time (GMT Correction) Type: **gmt -hh:mm<ENTER>** b. Enter local time (Local Time of Day) Type: **time hh:mm:ss<ENTER>** c. Enter date: (Change Date) Type: **date mm/dd/yy<ENTER>** or **date mm/dd/yyyy<ENTER>** d. Enter local lat (Latitude) Type: **lat (±) dd mm ss.sss<ENTER>** e. Enter local lon (Longitude) Type: **lon (±)ddd mm ss.sss<ENTER>** f. Enter local hgt (Height) Type: **hgt xxx.xx gps<ENTER>**
18	On **Enter Command** line, change receiver to **Position Fix Mode** command. Type: **mode f<ENTER>** On the Response line: Receiver in Position Fix Mode *Note:* After Step 18, almanac is automatically loaded from internal memory.
19	The receiver must acquire a current almanac and a Position 2D or 3D Fix. Press F3 to view the almanac. If no Position 2D or 3D FIX obtained after five minutes, execute the **Set to Default** command. Type: **default <ENTER>** Then, execute the above commands again. *Note:* The Set To Default command resets the ONCORE Receiver and clears all RAM including the almanac.
20	Before proceeding, wait until a 3D FIX and a current almanac are acquired. *Note:* A delay of approximately 25 minutes is possible before the receiver finds the satellite and receives an almanac.

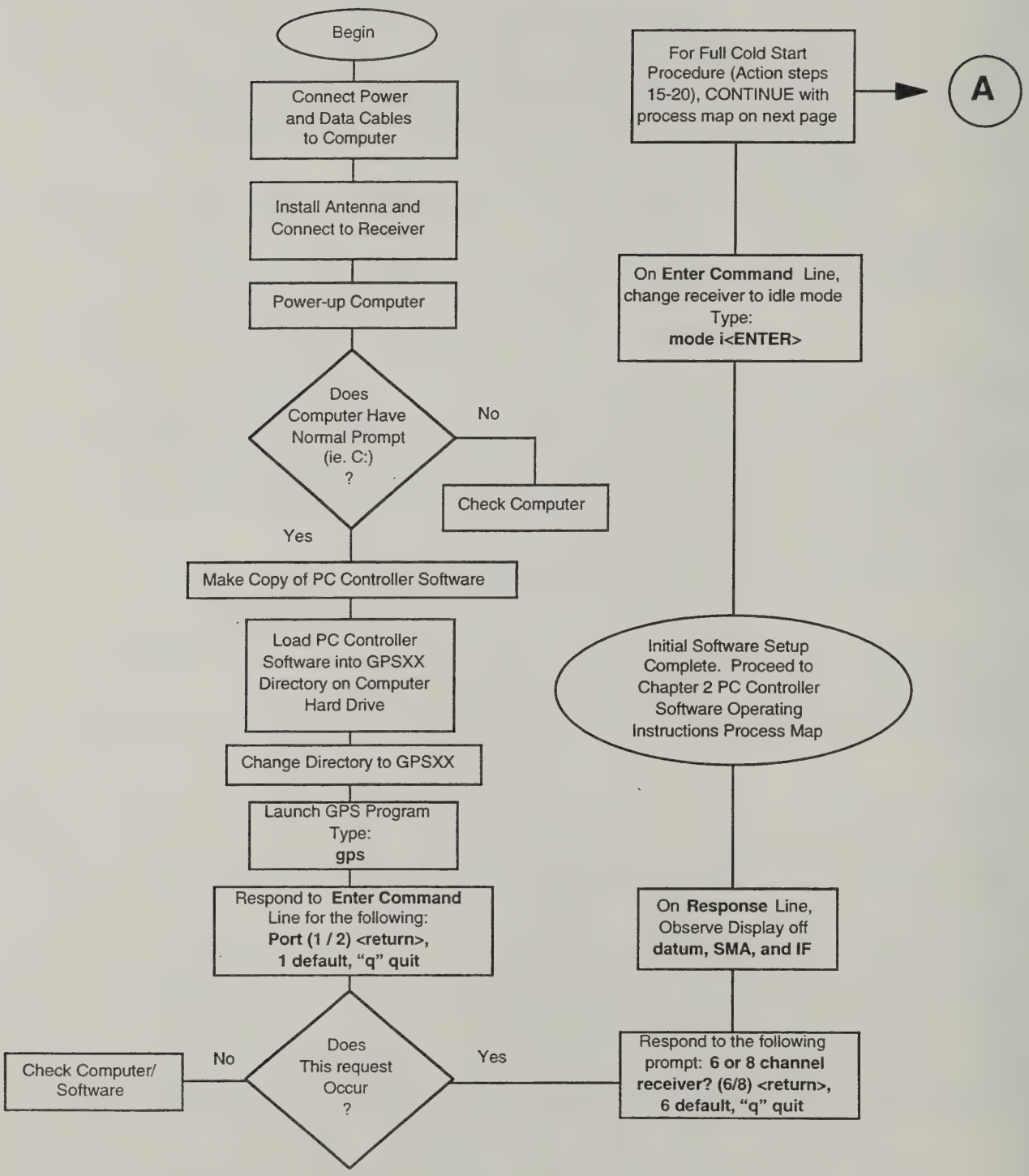


Figure 8: ONCORE Initial Software Setup and Full Cold Start Process Map

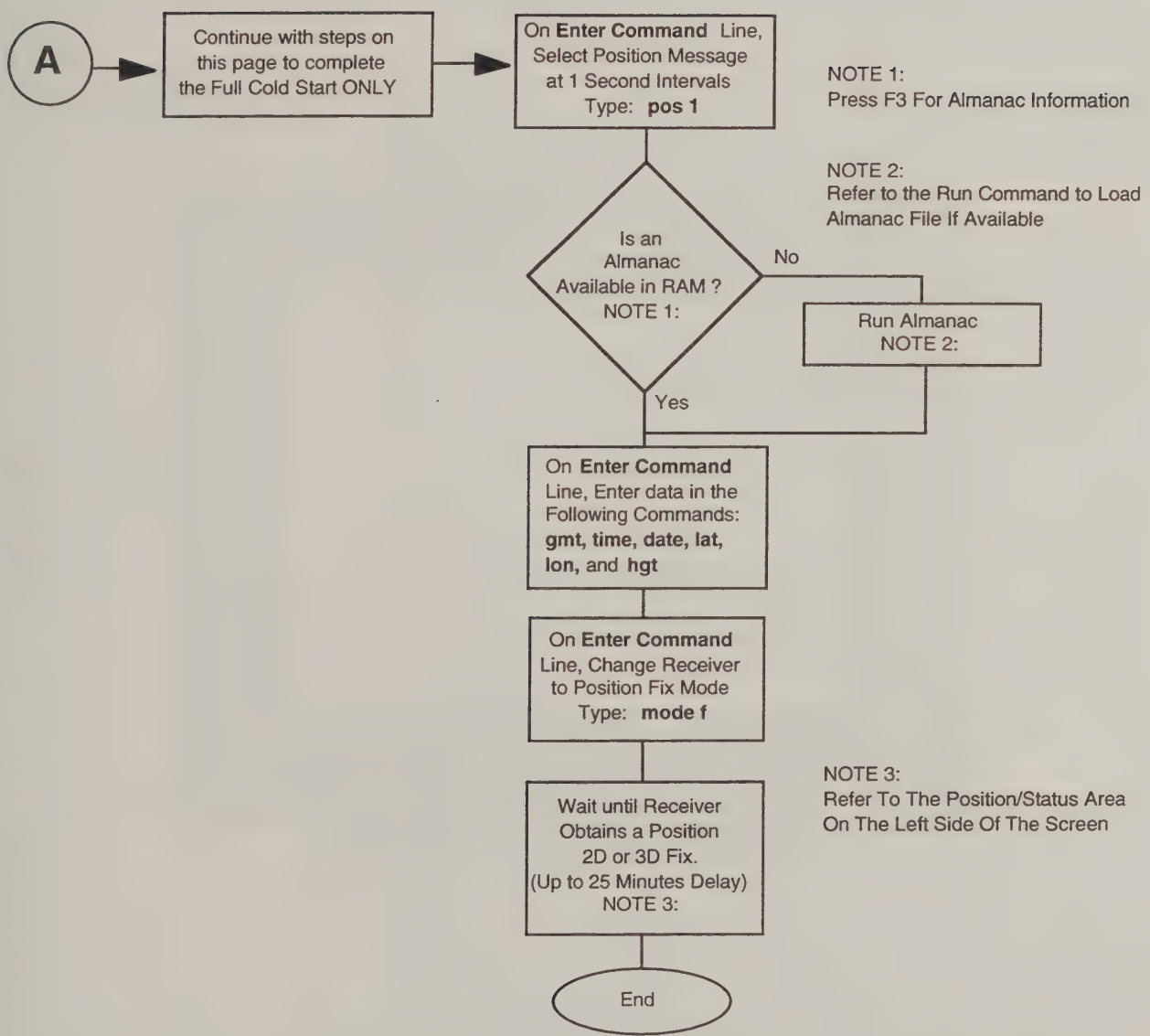


Figure 8: ONCORE Initial Software Setup and Full Cold Start Process Map (cont.)

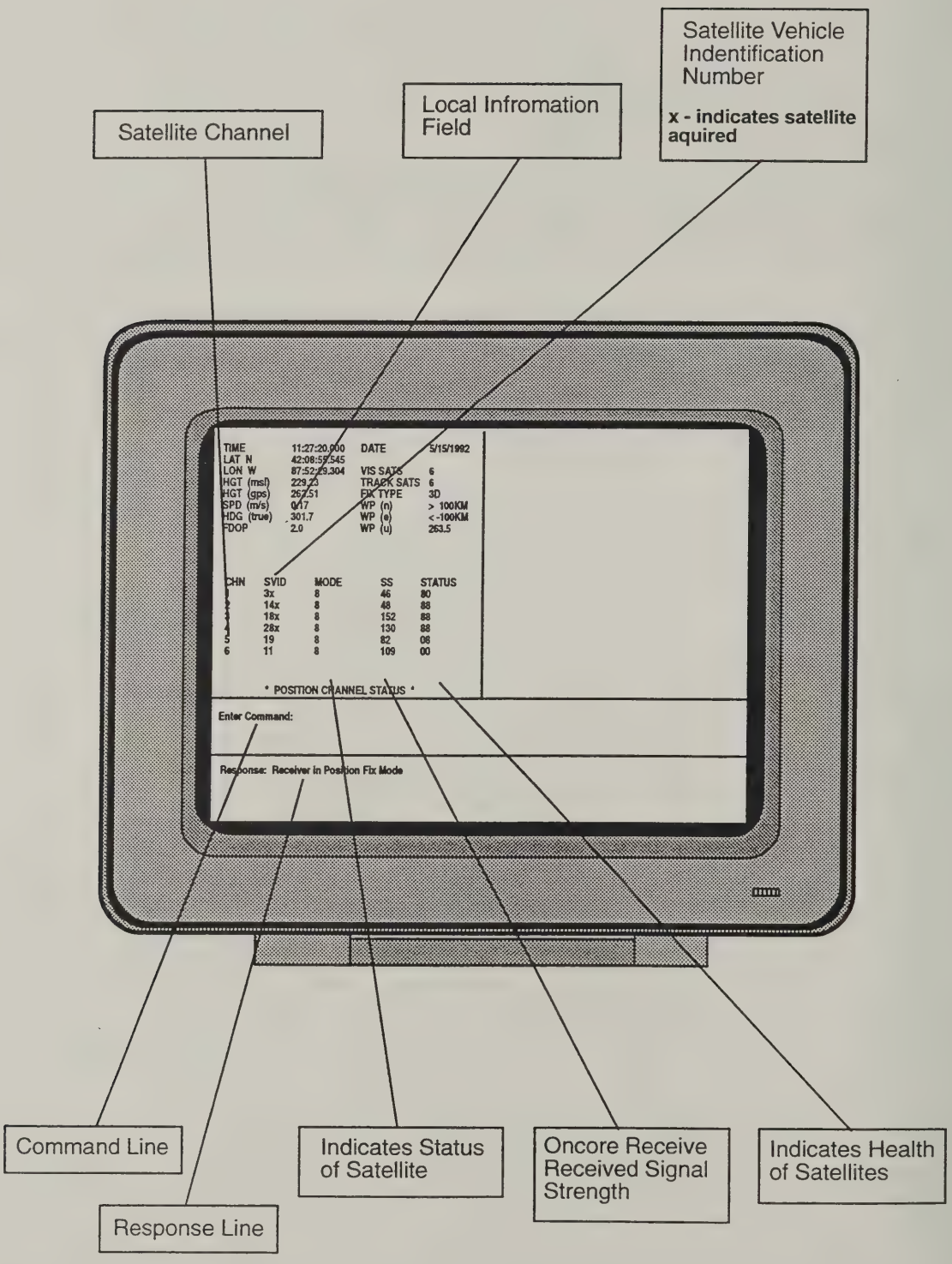


Figure 9: Display Screen

PC Controller Operating Instructions

Purpose of PC Controller Software Program

This program is a user friendly tool used with the ONCORE Evaluation Kit for rapid prototyping of responses and commands sent and received by the ONCORE Receiver. Special features of the program are:

- English commands for most binary I/O command listed in the technical reference
- Simple readouts for receiver responses displayed on the computer.

General Description of Process of Using PC Controller

After all hardware setup is completed, a gpsXX directory (check diskette for appropriate version of directory in place of XX) is made on the hard drive. The PC Controller Software is then loaded into the gpsXX directory. In the gpsXX directory, type **gps** to run the software program.

The screen display is divided into four areas. The top part of the screen shows two large boxes side by side. Below these top two areas are two wider areas that rest one over the other and stretch the entire width of the screen. The top right hand area has no information at first. The remaining three areas have information that either request the operator to input data or to read receiver responses. The top left hand area contains the software **name, part number, version number,** and **release date.** The first box below the two larger boxes is the **Command Line.** You will input commands at this location. The bottom area is the receiver's **Response Line.**

Selecting the correct Comm Port provides an I/O path between the computer and ONCORE Receiver and starts the receiver initialization. After receiver initialization, the top left hand screen contains data used to acquire satellites. The **Response** area contains datum information. Put the receiver in fixed mode operation. Example: **pos fix**<ENTER> The Response line confirms the mode requested. Typing the pos fix command starts the satellite acquisition process.

Requesting a position update once each second updates the data on the display screen one time each second. Example: **POS 1** <ENTER>

The data in the top left hand area of the display monitor gives the position data for this receiver location. Satellites are acquired when an X appears beside the satellite identification number in the top left hand area of the display monitor ("SVID" column). Note the actions of some of the function keys are tied to the selection of channels (6 or 8) at the startup of the PC controller software. For example, pressing the <F2> key will send either **dop** or **dp8**, depending on whether the ONCORE receiver is 6- or 8-channel. Check the almanac by pressing <F3>. **RAM Almanac** and the **EEPROM Almanac** data will be displayed in the top right hand area of the display monitor.

DESCRIPTION OF MOST USED COMMANDS

The following is a list of commands and a description of those commands. This is not a complete list of commands, but only a list of the most commonly used commands. When entering these commands, use the example shown.

1	To enter a new reference point or change the default reference point, use the **Set Reference Point** command. Type: **Refpt lat lon hgt <ENTER>** *lat ±dd mm ss.sss* *lon ±dd mm ss.sss* *hgt ±mmmmm.mm*
2	To reduce the Time To First Fix, enter data in the **GMT Correction** command as shown below. a. Locate the Greenwich Mean Time (GMT) offset for your local time zone. (Refer to the World Map and Time Zones) b. Type: **gmt (-)hh: mm<ENTER>** *hh* hours [00 to 23] *mm* minutes [00 to 59] *Note:* Use (-) for zones west of Greenwich. c. Enter approximate latitude in the **Latitude** command: Type: **lat (-)dd mm ss.sss<ENTER>** *dd* degrees [00 to 90]* *mm* minutes [0 to 59] *ss.sss* [00,000 to 59,000] * Estimate to within 1 degree of your location. *Note:* Use (-) for areas south of the Equator. d. Enter approximate longitude in the **Longitude** command: Type: **lon (-)ddd mm ss.sss <ENTER>** *ddd* [180 to +180]* *mm* [00 to 59] *ss.sss* [00,000 to 59,000] * Estimate to within 2 degrees your location. *Note:* Use (-) for areas west of the Prime Meridian (Greenwich) e. Enter approximate height in the **Height** command: Type: **hgt (-)hhhhh.hh [gps | msl]** (*hhhhh.hh* [1000.00 to 18000.00 meters]) *gps* GPS ellipsoid height *msl* MSL height (mean sea level) *Note:* After value, type one of the two height types above (gps | msl)
3	To select Position Fix Mode, use the **Position Fix Mode Option** command. Type: **mode f**
4	To update and display Position/Channel Status Message use the **Position/ Channel Status Message** command. On the left side of the monitor screen, check the displayed position/channel message information. Type: **pos [0...255]** (6-channel receiver) or **ps8 [0...255]** (8-channel receiver) *0* Discontinues the display screen updating. *1...255* Updates the display screen at a 1...255 second interval rate.
5	To set altitude hold fixed height, use the **Altitude Hold Fixed Height** command. Type: **ahp hhhhh.hh [gps | msl]** (*hhhhh.hh* [-1000.00 to 18000.00 meters]) *gps* GPS ellipsoid height *msl* MSL height *Note:* After value, type one of the two height types above (gps | msl)

6	To set altitude hold enable/disable, use the **Altitude Hold Enable/Disable** command. Type: **ah [d | e]** *d* disable *e* enable
7	To set almanac data output message, use the **Almanac Data Output Message** command. Type: **almout [0 | 1]** *0* output one time *1* output upon change
8	To change current receiver date, use the **Change Date** command. Type: **date mm dd yy/yyyy** *mm* month *dd* day *yy or yyyy* year
9	To output latest event input message to the control port, use the **Event Input Enable/Disable** command. Type: **ei [d | e]** *d* disable *e* enable

Function Key and Screen Display

Overview

The computer keyboard function keys F1 to F10 associate with screen displays. The computer display monitor presents these displays in the top right hand corner of the display screen. Refer to the computer display screen on the next page.

Use this table to determine which Function Key to select for a particular screen display.

Function Key	Screen Display
F1	Visible Satellite Status
F2	Dilution of Precision Table Status
F3	Almanac Status
F4	Almanac data
F5	Ephemeris Data
F6	Satellite Range Data
F7	Pseudorange Correction data
F8	Self Test
F9	Alert Planning Data
F10	Event Message Record
Shift-F1	Extension Data
Shift-F4	Time RAIM Setup & Status - OPTIONAL FEATURE
Ctrl-F3	Navigation Data - OPTIONAL FEATURE

Chapter 3
Description of Receiver Operation

About Receiver Operation

Typing the GPS command into the computer causes the computer to use the PC Controller software program to initialize the receiver. The receiver initializes into the mode, in which it was last operating, when last powered down (Position Fix or Idle Mode).

Receiver Initialization

To prompt receiver initialization, type gps<ENTER> and respond to all prompts appearing on the screen.

The PC Controller Software performs the following functions to initialize the receiver.

- Displays the Motorola copyright on the left side of the computer screen.
- Prompts to select COM1 or COM2 as a port for RS-232 communication.
- Prompts to select the number of channels (6 or 8).
- Sets the receiver up to use **Motorola Binary Format.**
- Updates the receiver date and time with the system date and time from the computer.
- Receives data from the receiver for display at the bottom of the computer screen.
- Reads reference point default data (waypoint data) in the computer file GPS DFLT.DTA.

COMM Port Prompt

Select a COMM port for communication between the RS-232, the PC Controller software program and the receiver. Default is COM1.

GMT Offset Prompt

After acquiring a position fix, receiver displays Greenwich Mean Time (GMT) unless the operator enters the GMT offset for the local time zone.

Default Reference Point Prompt

After initialization, the PC Controller software program reads default reference point (waypoint data in the RAM file **GPS DFLT.DTA**. The default reference point shows the difference between the present location and the default reference point. The following table lists the factory default reference points resident in **GPS DFLT.DTA** file.

Command	Description	Default Value
lat	Latitude	000 00 00.000
lon	Longitude	000 00 000.000
hgt	Altitude	000 00 000.000

Differences Between Reference Point and Current Position

The ONCORE receiver compares the current position data to the reference point data stored in the GPS DFLT.DTA file. The POSITION CHANNEL STATUS command displays the differences between the current position and the stored reference points as north, east, and up offset components.

Changing default Reference Point

Changing the default reference point provides a method of viewing differences in position from a reference or a known point. Store the changed reference point value in the PC Controller Software GPS_DFLT.DTA file, by typing the command QUIT<ENTER>.

Receiver Modes

The ONCORE receivers have two modes: Position Fix and Idle. In the Position Fix mode, receivers receive positioning data from the satellites; in Idle mode, receivers do not acquire new positioning data.

Time To First Fix

Applying power and setting the ONCORE receivers to Position Fix starts the receivers acquiring satellite data. After applying receiver power, the Time To First Fix (TTFF) required to fix a receiver position varies from seconds to several minutes.

Receiver Format Selection

Initializing the PC Controller software program sets the ONCORE receivers to the Motorola Binary format. The PC Controller software program controls the receiver only as long as the receiver is using the Motorola Binary format.

In the ONCORE Quick Start Kit, the ONCORE receivers communicate to the outside world through a serial interface using the Motorola Binary format. This command locks the receiver to the format selected and does not allow the receiver to communicate in any other format.

LORAN and NMEA formats do not work with the PC Controller Software used in the ONCORE Quick Start Kit. If evaluating the receiver in either LORAN or NMEA formats is necessary, use a terminal emulation software program.

Motorola Binary Message Format

Data messages used by the Motorola receivers consist of a variable number of binary characters. The message begins with the ASCII @@ characters and end with the ASCII carriage return <Cr> and line feed <Lf>. Refer to Motorola Receiver Technical Reference Manual for a complete description of binary data messages.

Input Message and Response Message Description

All Motorola Binary Format receiver input messages have a corresponding receiver response message. Checking the response message verifies the acceptance or rejection of the receiver input message commands.

Entering ASCII Input Commands

Use either the abbreviated PC Control commands or an ASCII command structure when entering input commands into the computer.

The Motorola Receiver Technical Reference Manual defines the ASCII command structure. When entering commands in ASCII format, the PC Controller software calculates the checksum and when required, enters carriage return (<Cr>) and line feed (<Lf>) automatically.

LORAN Technical Reference

For information on the LORAN format refer to the Motorola Receiver Technical Reference Manual.

NMEA-0183 Technical Reference

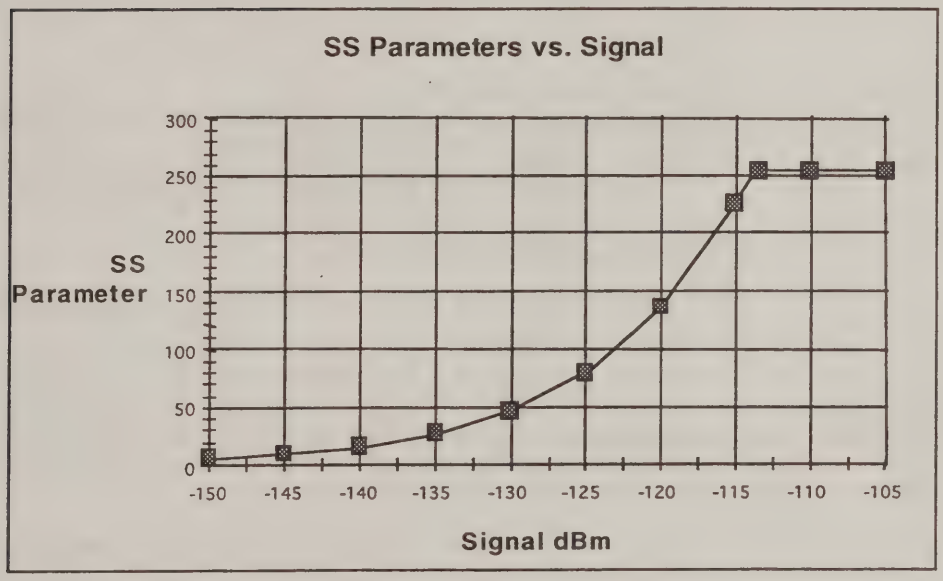
For information on the NMEA-0183 format refer to the Motorola Receiver Technical Reference Manual or contact:

NMEA-National Marine Electronics Association
330 W. Canton
Winter Park, Florida. 32789
(407) 612-3200

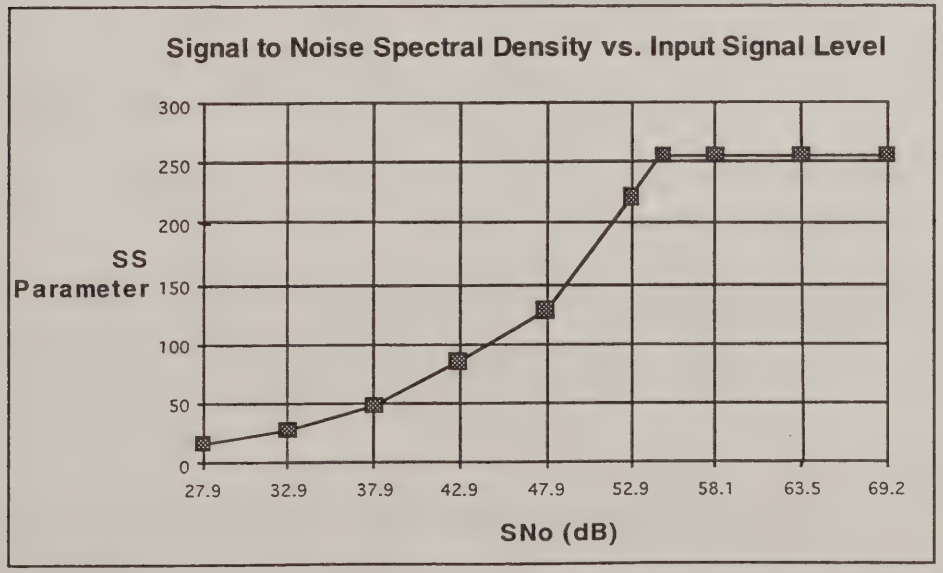
Signal Strength Parameters

Refer to the SS column on the left side of the PC Controller data screen for VISIBLE SATS STATUS. Press the Function Key (<F1>). The "ss" parameter stands for relative strength of the received satellite signal (refer to the graphs below). The accompanying formulas are approximations for the assumed typical receiver parameters and should be accurate to approximately ± 2dB. Formula 1 translates signal strength (ss) to dBm, and Formula 2 yields the signal to noise ratio (SNo). Both formulas assume a 1 Hz bandwidth. The greatest margin of error will occur at the stronger levels, and the formulas will not work at levels where "ss" has been limited (ss = 255 max).

Formula 1: dBm = 20 * Log10 [ss] - 163.4



Formula 2: SNo = 20 * Log10 [ss] + 4.6



Upload and Download Almanacs and Ephemeris Data

The ability to upload an almanac or ephemeris data set from a file can be very useful in reducing the time to first fix or initializing a receiver with an old almanac. The PC Controller program provides the following capabilities:

Download Almanacs and Ephermeris Data

To record an almanac to a file:

- Enter the command "record alm <ENTER>" into the PC Controller.
- Enter the command "almout 0 <ENTER>".
- Monitor the almanac data displayed for completion of almanac output (F4).
- Enter the command "record alm c".

The almanac has been stored in a file with a ".alm" extension in the current working directory.

To download ephemeris data:

- Enter the command "record eph <ENTER>" into the PC Controller.
- Enter the command "ephout 0 <ENTER>".
- Monitor the ephemeris data displayed for completion of ephemeris output (F5).
- Enter the command "record eph c".

The ephemeris data set has been stored in a file with a ".eph" extension in the current working directory.

Upload Almanacs and Ephermeris Data

To upload an almanac from a file to the receiver:

- Enter the command "run XXXXXXXX.alm <ENTER>" into the PC Controller where XXXXXXXX.alm is the almanac data file to be sent to the receiver.
- Monitor the almanac input response displayed for completion of almanac input.
  Function Key F3

To upload an ephemeris data set from a file to the receiver:

- Enter the command "run XXXXXXXX.eph <ENTER>" into the PC Controller where XXXXXXXX.eph is the ephemeris data file to be sent to the receiver.
- Monitor the ephemeris data displayed for completion of ephemeris input.
  Function Key F5

Almanac File Naming Conventions

The following describes the conventions for naming almanacs.

Files saved to memory using the record command are saved by a time/date stamp and their specific file extension type.

Example:

94012801.alm

This is the name of an almanac file stored to the disk. The file name is a

time/date stamp. The file extension "alm" indicates that it is an almanac file. The file name has the following breakdown:

94012801.alm:

94 is the year

01 is the month

28 is the day of the month

01 is the first almanac record recorded

Record Data

Your Motorola GPS receiver will record data to a PC by using the record command. You can then use software application programs such as Microsoft Excel to process or view your data. You can record the following information:

- pos – Position/channel status (6-channel)
- ps8 – Position/channel status (8-channel)
- alm – Almanac data
- eph – Ephemeris data
- rng – Satellite range and range rate data (6-channel)
- rg8 – Satellite range and range rate data (8-channel)
- cor – Pseudorange correction data
- alt – Alert table data (6-channel)
- at8 – Alert table data (8-channel)
- evt – Event data (a user message written to a file corresponding to a user-defined event)
- bin – All data in binary format
- ext – Position/channel extension message (6-channel)
- et8 – Position/channel extension message (8-channel)
- trs – Time RAIM setup and status data (6-channel)
- ts8 – Time RAIM setup and status data (8-channel)

The record command:

The record command format is:

record [option]

Options are: pos, alm, eph, rng, cor, alt, evt, bin, trs, ps8, rg8, et8, at8, ts8

To start the recording process

Type in the appropriate command for the type of data you want to record. You may enter input commands in the upper or lower case. A file will be opened in the same directory as the PC Controller program. The data will be stored automatically in that file at the rate specified by you and/or the data type.

For example, the command **record pos** will start the recording process for position data.

NOTE: You also must request the data output from the receiver. For example, to record satellite range data, type:

```
RNG 1
RECORD RNG
```

To stop the recording process:

Type the record command as you did to start the recording process followed by the letter **c**. This command will close the file.

For example, **record pos c** stops the recording process for position data and closes the file.

Event Message Record Key, F10

Press the <F10> function key to open an event file with the .evt extension. At the moment <F10> is pressed, a file is created/opened. Answer the event "id" prompt with a file name of X characters in length and press <ENTER>. You can them type a text message, which can be stored and time tagged with the system time. To close the file, press <F10> again, or quit the program.

File Formats

Data recorded by the PC Controller program has specific file format information assoicated with it. File names are assigned automatically by thePC Controller program based on the date and the file number. File extension names are unique.

File format naming convention:

yymmdd##.ext

For example, a file name such as **92061604.eph** is a file created on the sixteenth of June, 1992. It is the fourth file of its type created that day, and its extension indicates it is ephemeris data.

The following table defines possible file types, formats, and file extenstions:

File Type	File Format	File Extension
Alert Table Data (6-channel)	Text	.alt
Alert Table Data (8-channel)	Text	.at8
All Data	Motorola Binary Format	.bin
Almanac Data	Motorola Binary Format	.alm
Ephemeris Data	Motorola Binary Format	.eph
Event Data	Text	.evt
Position/Channel Extension Data (6-channel)	Comma Separated Variable Format	.ext
Position/Channel Extension Data (8-channel)	Comma Separated Variable Format	.et8
Position/Channel Status (6-channel)	Comma Separated Variable Format	.pos
Position/Channel Status (8-channel)	Comma Separated Variable Format	.ps8
Pseudorange Correction Data	Comma Separated Variable Format	.cor
Range Data (6-channel)	Comma Separated Variable Format	.rng
Range Data (8-channel)	Comma Separated Variable Format	.rg8
Time RAIM Setup and Status (6-channel)	Comma Separated Variable Format	.trs
Time RAIM Setup and Status (8-channel)	Comma Separated Variable Format	.ts8

All Files Recorded in the Comma Separated Variable (CSV) format can be imported to Excel, Lotus, or other spreadsheet programs for plotting.

Import Data Files into Microsoft Excel

To import Comma Separated Variable (CSV) Format files into Microsoft Excel 5.0a, perform the following actions:

- Start the Microsoft Excel program.
- From the Microsoft Excel menu choose File, Open.
- Choose "All Files" [*.*] from the "File/Open/List Files of Type:" submenu.
- Change File/Open/Directory to PC Controller Program GPSXX.
- Select file from File/Open/File Name.
- Choose "Delimited" from the "Text Import Wizard/Original Date Type" (Step 1 of 3)
- Choose "Comma" from "Text Import Wizard/Delimitations (Step 2 of 3)

To import Comma Separated Variable Format files into Microsoft Excel 3.0/4.0, perform the following actions:

- Start the Microsoft Excel program.
- From the Microsoft Excel menu choose "File," "Open."
- Choose "Text" from the File/Open submenu.
- Choose "Comma" from the File/Open/Text submenu.
- Choose the data file from the appropriate directory.

On the following page is an example of position information recorded by the PC Controller program and imported into Microsoft Excel. The column headings, shown as shaded areas, are part of the data file as it is created by the PC Controller program. When you import the file in the Comma Separated Variable format, the column headings automatically appear at the top of each column.

If you want to import files into Excel 2.0, you must change the file name extension to .CSV before importing the file. Use the DOS Rename command as follows: to change the file DATA.POS to DATA.CSV, type the following:

RENAME DATA.POS DATA.CSV

month	day	year	hour	minutesx	seconds	lat(ms)	long(ms)	height	height_msl	north	east	vertical
1	1	1992	12	6	14.00093	228364	0	87999.75	88017.78	7158.9	0	–0.2
1	1	1992	12	6	15.00095	231449	–1	87999.85	88017.88	7255.6	0	–0.2
1	1	1992	12	6	16.00096	234536	–1	87999.87	88017.9	7352.4	0	–0.1
1	1	1992	12	6	17.00097	237623	–1	87999.87	88017.9	7449.2	0	–0.1
1	1	1992	12	6	18.00099	240710	–2	87999.87	88017.9	7545.9	–0.1	–0.1
1	1	1992	12	6	19	243792	–3	87999.86	88017.89	7642.6	–0.1	–0.1
1	1	1992	12	6	20.00001	246876	–3	87999.94	88017.96	7739.2	–0.1	–0.1
velocity	dop_type	dop	no_vis	no_tracked	revr_status	svid_1	ch_mode_1	sig_str_1	ch_stat_1	svid_2	ch_mode_2	sig_str_2
96.7	PDOP	1.9	9	5	20	4	8	61	80	9	8	61
96.7	PDOP	1.9	9	5	2	4	8	61	80	9	8	62
96.7	PDOP	1.9	9	5	20	4	8	60	80	9	8	62
96.7	PDOP	1.9	9	5	20	4	8	59	80	9	8	62
96.7	PDOP	1.9	9	5	20	4	8	60	80	9	8	61
96.7	PDOP	1.9	9	5	20	4	8	60	80	9	8	61
96.7	PDOP	1.9	9	5	20	4	8	60	80	9	8	61
ch_stat_2	ch_mode_3	sig_str_	ch_stat	svid_4	ch_mode_4	sig_str_4	ch_stat_4	svid_5	ch_mode_5	sig_str_5	ch_stat_5	svid_6
80	8	69	80	14	8	62	80	16	0	54	0	5
80	8	71	80	14	8	60	80	16	0	47	0	5
80	8	70	80	14	8	61	80	16	0	48	0	5
80	8	71	80	14	8	64	80	16	0	50	0	5
80	8	68	80	14	8	60	80	16	0	51	0	5
80	8	69	80	14	8	62	80	16	0	48	0	5
80	8	71	80	14	8	62	80	16	0	53	0	5
ch_mode_6	sig_str_6	ch_stat_6										
8	59	80										
8	59	80										
8	58	80										
8	59	80										
8	57	80										
8	58	80										
8	58	80										

Create Macros

A macro is a file you create containing a list of receiver commands to help you work more quickly and efficiently. Any command in the PC Controller Command List, or in Section 4. of the Motorola GPS Technical Reference manual, can be used in a macro file. It is suggested "run.<filename>" commands are not used within these macros unless it is the last command in a macro file.

You can use any unformatted text editor to create macro files. Examples include WordPerfect 5.1, Microsoft Word for Windows or the Edlin Text Editor in DOS. When you use a word processing application to create macro files, you must save the file as unformatted text; therefore, none of the page formatting information is included in the macro file. For more information, refer to the section on file formats in the reference manual of the word processing application you are using.

Some of the functions you can use macros to perform for you are:

- Enter default parameters such as latitude, longitude, height, and Greenwich Mean Time (GMT) offset.
- Record preselected receiver data.
- Record all receiver data for later review or post-processing.
- Close selected or all files.
- Post-process specific data file types from ".all" files.

File names are limited to eight characters with a three-character file extension; i.e., cccccccc.ccc

Run a macro file by typing the run command at the command prompt , followed by the name of your macro file.

For example:

run testfile.dta

Example 1: This macro fill set the date, the GMT offset, latitude, longitude, and height, and force the receiver into the position fix mode. Wait two minutes, then record all data to a file.

```
date 12 12 92
gmt –07:00
lat 60 50 10.999
lon 100 20 20.555
hgt 1000 g
mode f
pause 120
record bin
```

NOTE: The pause command is as follows:

pause [1 . .255] (units are seconds)

Example 2: This macro will record position, almanac, and alert planning data.

```
record pos
pos 1
record alm
almout 1
record eph
ephout 1
```

Example 3: This macro will close all data files.

```
record pos c
record alm c
record eph c
record rng c
record cor c
record alt c
record evt c
record bin c
```

Post-Processing Data

You can review data recorded in a file using the PC Controller program. Post-processing requires replacing the serial connection from the receiver to the computer with a "loop back connector" that plugs into the serial port of the computer and ties the output of serial data back to the inputs. Loopback connectors are not included in your evaluation kit. You must make a loopback connector. The following is a list of the pin numbers for standard 9-pin and 25-pin D connectors that must be connected to make a loopback connector.

For a 25-pin D connector, connect the following pins:

pin 2 to pin 3

pin 4 to pin 5 to pin 8

pin 6 to pin 20

pin 22 to pin 23

(pins 1, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 24, 25 – no connection)

For a 9-pin D connector, connect the following pins:

pin 2 to pin 3

pin 4 to pin 6

pin 7 to pin 8

(pins 1, 5, 9 – no connection)

To review data stored in a file, perform the following actions:

1. Remove the connector connecting the serial computer port to the receiver module.
2. Connect the loopback connector to the serial port of the computer. The computer does not have to be off while installing the connector.
3. Run the GPS program.
4. Run your data file using the Run command.

When the data file is running, the keyboard will not respond to commands – even the Quit command.

Record Specific Data File Types from a ".BIN" File

A ".BIN" file will contain all data output by the receiver at time of recording.

Record any of the specific data file types from a ".BIN" file by entering the record command for the specific file type, then running the ".BIN" file.

For example, with the GPS program running, enter:

record pos<ENTER>

run filename.bin

This set of commands will record the position information from the ".BIN" file in a new file. The position information file created will follow the naming convention as stated previously. The file extension will be ".pos". Position information is stored in Comma Separated Variable (CSV) Format. This file can then be imported into applications such as Microsoft Excel for plotting. You could also execute this sample program as a macro file.

Chapter 4
PC Controller Command List Reference

Overview

The following is the command entry list for the PC Controller software. The commands appear in the form of mnemonics with an associated narrative description of the commands. Refer to Chapter 6 of the Motorola GPS Technical Reference manual, document No. 68P41117U01, for a full binary breakout and description of each command. On some commands, there are "See Also" entries. These related commands have a cause and effect on the specific command.

- ( ) indicates optional entries and [a | b] denotes command entry options; i.e., enter either a or b.
- For optional entries, if you enter the command without the optional entries the receiver will output the current state associated with that command.
- With the exception of the record command, all commands with command entries accept a short form for the command entry options (i.e., accept the first letter of the command entry or accept the equivalent entry number). For example, the altitude hold disable/enable command has the following form:

  To enable altitude hold, type:

  ah enable<ENTER>

  or

  ah e<ENTER>

  or

  ah 1<ENTER>

- Either upper or lower case is accepted by the controller. The controller reduces all user input to lower case before processing

The two tables that follow provide a cross reference between the controller mnemonic command and the binary command. One table is sorted alphabetically by Function, and one table is sorted alphabetically by Binary Command.

Controller and Binary Commands Cross References

Note: This is a Quick Reference of PC controller commands. The commands are listed by both the "controller command" and the "binary @@ command".

Cross Reference ***by Function*** *Command*

Function	Description	Controller Command	Default Setting	Binary Command	User Guide Page #
1PPS	MEASUREMENT EPOCH OFFSET OPTION	NONE	0.000	@@Ax	6.56
1PPS	TIME RAIM SETUP AND STATUS 6-CHANNEL	trstat	Time RAIM Algorithm "OFF"	@@Bn	6.104
1PPS	TIME RAIM SETUP AND STATUS 8-CHANNEL	trstat8	Time RAIM Algorithm "OFF"	@@En	6.140
1PPS	1PPS TIME OFFSET	ppsoff	0	@@Ay	6.58
ALERT-PLANNING	ALERT PLANNING - 6-CHANNEL	alert	N/A	@@Cd	6.112
ALERT-PLANNING	ALERT PLANNING - 8-CHANNEL	alert8	N/A	@@Fd	6.146
ALMANAC	ALMANAC UPDATE OPTION	almhold	Update	@@An	6.32
ALMANAC	ALMANAC STATUS MESSAGE	alm	Polled	@@Bd	6.82
ALMANAC	ALMANAC DATA OUTPUT MESSAGE	almout	Polled	@@Be	6.84
ALMANAC	ALMANAC DATA INPUT	almin	N/A	@@Cb	6.111
APPLICATION	APPLICATION TYPE	aptype	Land	@@AB	6.64
BROADCAST	SATELLITE BROADCAST DATA MESSAGE	NONE	Polled	@@Bl	6.102
CABLE DELAY	1PPS CABLE DELAY OPTION	ppsdelay	0.000	@@Az	6.60
DATE	DATE	date	No change	@@Ac	6.10
DATUM	DATUM ID CODE	datum	WGS-84	@@Ao	6.34
DATUM	USER DEFINED DATUMS	udatum	WGS-84	@@Ap	6.36
DEFAULTS	SET-TO-DEFAULTS	default	N/A	@@Cf	6.118
DOP	xDOP TYPE	doptype	PDOP	@@Aj	6.24
DGPS	DIFFERENTIAL CORRECTION TIME-OUT	dto	90 seconds	@@AJ	6.72
DGPS	OUTPUT PSEUDORANGE CORRECTION OUTPUT MESSAGE	corout	Polled	@@Bh	6.92
DGPS	PSEUDORANGE CORRECTION INPUT	corin	N/A	@@Ce	6.116
DOP - 6CH	xDOP TABLE STATUS MESSAGE - 6-CHANNEL	dop	Polled	@@Bc	6.80
DOP - 8CH	xDOP TABLE STATUS MESSAGE - 8-CHANNEL	dp8	Polled	@@Ec	6.130
EPHEMERIS	EPHEMERIS HOLD OPTION	ephhold	Disable	@@AA	6.62
EPHEMERIS	INPUT EPHEMERIS DATA	ephin	N/A	@@Bf	6.86
EPHEMERIS	EPHEMERIS DATA OUTPUT MESSAGE	ephout	Polled	@@Bi	6.94
EXTENSION MSG	POSITION/STATUS/DATA EXTENSION MSG. - 6-CH	ext	Polled	@@Bk	6.98
EXTENSION MSG	POSITION/STATUS/DATA EXTENSION MSG. - 8-CH	et8	Polled	@@Ek	6.136
FIX	POSITION FIX ALGORITHM TYPE	fix	N-in-view	@@Ar	6.42
FIX/IDLE	POSITION FIX/IDLE MODE OPTION	mode	Idle	@@Cg	6.120
HOLD	HOLD POSITION PARAMETERS	php	0	@@As	6.44
HOLD	POSITION-HOLD OPTION	ph	Disable	@@At	6.46
HOLD	ALTITUDE-HOLD HEIGHT PARAMETER	ahp	0	@@Au	6.48
HOLD	ALTITUDE-HOLD OPTION	ah	Disable	@@Av	6.50
HEIGHT	HEIGHT	hgt	0.00	@@Af	6.16

Cross Reference ***by Function*** *Command (cont.)*

Function	Description	Controller Command	Default Setting	Binary Command	User Guide Page #
ID	RECEIVER ID COMMAND STRING	id	N/A	@@Cj	6.124
IGNORE	SATELLITE IGNORE LIST	ignore	None	@@Am	6.30
IONOSPHERE	IONOSPHERE CORRECTION OPTION	ion	Enable	@@Aq	6.40
LATITUDE	LATITUDE	lat	0 degrees	@@Ad	6.12
LEAP	LEAP SECOND PENDING STATUS MESSAGE	leapsec	Polled	@@Bj	6.96
LONGITUDE	LONGITUDE	lon	0 degrees	@@Ae	6.14
LORAN	SWITCH I/O FORMAT	NONE	N/A	BIN	6.170
LORAN	OUTPUT TIME INTERVAL	NONE	Polled	T	6.168
LORAN	POSITIONING DATA OUTPUT	NONE	Polled	Z	6.166
MASK	SATELLITE MASK ANGLE	mask	10 degrees	@@Ag	6.18
NMEA	SWITCH I/O FORMAT	NONE	N/A	FOR	6.164
NMEA	GPGGA (GPS FIX DATA)	NONE	Polled	GGA	6.150
NMEA	GPGLL (GEOGRAPHIC POSITION-LATITUDE/LONGITUDE)	NONE	Polled	GLL	6.154
NMEA	GPGSA (GPS DOP AND ACTIVE SATELLITES)	NONE	Polled	GSA	6.156
NMEA	GPGSV (GPS SATELLITES IN VIEW)	NONE	Polled	GSV	6.158
NMEA	GPRMC (RECOMMENDED MINIMUM SPECIFIC GPS/TRANSIT DATA)	NONE	Polled	RMC	6.152
NMEA	GPVTG (TRACK MADE GOOD AND GROUND SPEED)	NONE	Polled	VTG	6.160
NMEA	GPZDA (TIME AND DATE)	NONE	Polled	ZDA	6.162
POSITION - 6CH	POSITION/STATUS/DATA OUTPUT MESSAGE - 6-CH	pos	Polled	@@Ba	6.74
POSITION - 8CH	POSITION/CHANNEL DATA - 8-CHANNEL	ps8	Polled	@@Ea	6.126
RANGE	OUTPUT ALIGN	NONE	Disable	@@AE	6.70
RANGE DATA-6CH	SATELLITE RANGE DATA OUTPUT MESSAGE - 6-CH	rng	Polled	@@Bg	6.88
RANGE DATA-8CH	SATELLITE RANGE DATA OUTPUT MESSAGE - 8-CH	rg8	Polled	@@Eg	6.132
SATELLITE	SATELLITE SELECT	ss	None	@@Ai	6.22
SATELLITE	SATELLITE SELECT OPTIONS	sm	Automatic	@@Ah	6.20
SATELLITE	VISIBLE SATELLITE STATUS MESSAGE	vis	Polled	@@Bb	6.78
SELF-TEST - 6CH	SELF-TEST - 6-CHANNEL	selftest	N/A	@@Ca	6.108
SELF-TEST - 8CH	SELF-TEST - 8-CHANNEL	selftest8	N/A	@@Fa	6.144
SWITCH	SWITCH I/O FORMAT	ioformat	Motorola	@@Ci	6.122
THRESHOLD	2-D TO 0-D HDOP THRESHOLD	dopmask	12.0	@@AC	6.66
THRESHOLD	xDOP HYSTERESIS	dophys	1.0	@@Ak	6.26
THRESHOLD	3-D TO 2-D xDOP THRESHOLD	dopthr	6.0	@@Al	6.28
THRESHOLDS	CORRECTION THRESHOLDS	corthr	0/32	@@AD	6.68
TIME	GMT	gmt	00:00	@@Ab	6.8
TIME	TIME OF DAY	time	No change	@@Aa	6.6
TIME	UTC TIME CORRECTION OPTION	utc	Enable	@@Aw	6.52

Cross Reference ***by Binary*** *Command*

Function	Description	Controller Command	Default Setting	Binary Command	User Guide Page #
EPHEMERIS	EPHEMERIS HOLD OPTION	ephhold	Disable	@@AA	6.62
TIME	TIME OF DAY	time	No change	@@Aa	6.6
APPLICATION	APPLICATION TYPE	aptype	Land	@@AB	6.64
TIME	GMT	gmt	00:00	@@Ab	6.8
DATE	DATE	date	No change	@@Ac	6.10
THRESHOLD	2-D TO 0-D HDOP THRESHOLD	dopmask	12.0	@@AC	6.66
LATITUDE	LATITUDE	lat	0 degrees	@@Ad	6.12
THRESHOLDS	CORRECTION THRESHOLDS	corthr	0/32	@@AD	6.68
LONGITUDE	LONGITUDE	lon	0 degrees	@@Ae	6.14
RANGE	OUTPUT ALIGN	NONE	Disable	@@AE	6.70
HEIGHT	HEIGHT	hgt	0.00	@@Af	6.16
MASK	SATELLITE MASK ANGLE	mask	10 degrees	@@Ag	6.18
SATELLITE	SATELLITE SELECT OPTIONS	sm	Automatic	@@Ah	6.20
SATELLITE	SATELLITE SELECT	ss	None	@@Ai	6.22
DOP	xDOP TYPE	doptype	PDOP	@@Aj	6.24
DGPS	DIFFERENTIAL CORRECTION TIME-OUT	dto	90 seconds	@@AJ	6.72
THRESHOLD	xDOP HYSTERESIS	dophys	1.0	@@Ak	6.26
THRESHOLD	3-D TO 2-D xDOP THRESHOLD	dopthr	6.0	@@Al	6.28
IGNORE	SATELLITE IGNORE LIST	ignore	None	@@Am	6.30
ALMANAC	ALMANAC UPDATE OPTION	almhold	Update	@@An	6.32
DATUM	DATUM ID CODE	datum	WGS-84	@@Ao	6.34
DATUM	USER DEFINED DATUMS	udatum	WGS-84	@@Ap	6.36
IONOSPHERE	IONOSPHERE CORRECTION OPTION	ion	Enable	@@Aq	6.40
FIX	POSITION FIX ALGORITHM TYPE	fix	N-in-view	@@Ar	6.42
HOLD	HOLD POSITION PARAMETERS	php	0	@@As	6.44
HOLD	POSITION-HOLD OPTION	ph	Disable	@@At	6.46
HOLD	ALTITUDE-HOLD HEIGHT PARAMETER	ahp	0	@@Au	6.48
HOLD	ALTITUDE-HOLD OPTION	ah	Disable	@@Av	6.50
TIME	UTC TIME CORRECTION OPTION	utc	Enable	@@Aw	6.52
1PPS	MEASUREMENT EPOCH OFFSET OPTION	NONE	0.000	@@Ax	6.56
1PPS	1PPS TIME OFFSET	ppsoff	0	@@Ay	6.58
CABLE DELAY	1PPS CABLE DELAY OPTION	ppsdelay	0.000	@@Az	6.60
POSITION - 6CH	POSITION/STATUS/DATA OUTPUT MESSAGE - 6-CH	pos	Polled	@@Ba	6.74
SATELLITE	VISIBLE SATELLITE STATUS MESSAGE	vis	Polled	@@Bb	6.78
DOP - 6CH	xDOP TABLE STATUS MESSAGE - 6-CHANNEL	dop	Polled	@@Bc	6.80
ALMANAC	ALMANAC STATUS MESSAGE	alm	Polled	@@Bd	6.82
ALMANAC	ALMANAC DATA OUTPUT MESSAGE	almout	Polled	@@Be	6.84
EPHEMERIS	INPUT EPHEMERIS DATA	ephin	N/A	@@Bf	6.86

Cross Reference ***by Binary*** *Command (cont.)*

Function	Description	Controller Command	Default Setting	Binary Command	User Guide Page #
RANGE DATA-6CH	SATELLITE RANGE DATA OUTPUT MESSAGE - 6-CH	rng	Polled	@@Bg	6.88
DGPS	OUTPUT PSEUDORANGE CORRECTION OUTPUT MESSAGE	corout	Polled	@@Bh	6.92
EPHEMERIS	EPHEMERIS DATA OUTPUT MESSAGE	ephout	Polled	@@Bi	6.94
LEAP	LEAP SECOND PENDING STATUS MESSAGE	leapsec	Polled	@@Bj	6.96
EXTENSION MSG	POSITION/STATUS/DATA EXTENSION MSG. - 6-CH	ext	Polled	@@Bk	6.98
BROADCAST	SATELLITE BROADCAST DATA MESSAGE	NONE	Polled	@@Bl	6.102
1PPS	TIME RAIM SETUP AND STATUS 6-CHANNEL	trstat	Time RAIM Algorithm "OFF"	@@Bn	6.104
SELF-TEST - 6CH	SELF-TEST - 6-CHANNEL	selftest	N/A	@@Ca	6.108
ALMANAC	ALMANAC DATA INPUT	almin	N/A	@@Cb	6.111
ALERT-PLANNING	ALERT PLANNING - 6-CHANNEL	alert	N/A	@@Cd	6.112
DGPS	PSEUDORANGE CORRECTION INPUT	corin	N/A	@@Ce	6.116
DEFAULTS	SET-TO-DEFAULTS	default	N/A	@@Cf	6.118
FIX/IDLE	POSITION FIX/IDLE MODE OPTION	mode	Idle	@@Cg	6.120
SWITCH	SWITCH I/O FORMAT	ioformat	Motorola	@@Ci	6.122
ID	RECEIVER ID COMMAND STRING	id	N/A	@@Cj	6.124
POSITION - 8CH	POSITION/CHANNEL DATA - 8-CHANNEL	ps8	Polled	@@Ea	6.126
DOP - 8CH	xDOP TABLE STATUS MESSAGE - 8-CHANNEL	dp8	Polled	@@Ec	6.130
RANGE DATA-8CH	SATELLITE RANGE DATA OUTPUT MESSAGE - 8-CH	rg8	Polled	@@Eg	6.132
EXTENSION MSG	POSITION/STATUS/DATA EXTENSION MSG. - 8-CH	et8	Polled	@@Ek	6.136
1PPS	TIME RAIM SETUP AND STATUS 8-CHANNEL	trstat8	Time RAIM Algorithm "OFF"	@@En	6.140
SELF-TEST - 8CH	SELF-TEST - 8-CHANNEL	selftest8	N/A	@@Fa	6.144
ALERT-PLANNING	ALERT PLANNING - 8-CHANNEL	alert8	N/A	@@Fd	6.146
LORAN	SWITCH I/O FORMAT	NONE	N/A	BIN	6.170
NMEA	SWITCH I/O FORMAT	NONE	N/A	FOR	6.164
NMEA	GPGGA (GPS FIX DATA)	NONE	Polled	GGA	6.150
NMEA	GPGLL (GEOGRAPHIC POSITION-LATITUDE/LONGITUDE)	NONE	Polled	GLL	6.154
NMEA	GPGSA (GPS DOP AND ACTIVE SATELLITES)	NONE	Polled	GSA	6.156
NMEA	GPGSV (GPS SATELLITES IN VIEW)	NONE	Polled	GSV	6.158
NMEA	GPRMC (RECOMMENDED MINIMUM SPECIFIC GPS/TRANSIT DATA)	NONE	Polled	RMC	6.152
LORAN	OUTPUT TIME INTERVAL	NONE	Polled	T	6.168
NMEA	GPVTG (TRACK MADE GOOD AND GROUND SPEED)	NONE	Polled	VTG	6.160
LORAN	POSITIONING DATA OUTPUT	NONE	Polled	Z	6.166
NMEA	GPZDA (TIME AND DATE)	NONE	Polled	ZDA	6.162

The command name is the mnemonic for the command. Enter it exactly as shown. The parameter list contains one or more parameters for the command. Parameters listed inside square brackets ([ ]) are mutually exclusive choices. For example [e | d] means enter either "e" or "d." The bar character (|) is a separator and is not part of the entry. Separate each parameter with at least one space.

For most commands, entering the command name mnemonic without parameters will return the current setting for that command. The "Notes" section describes exceptions for that command.

You can only enter one command at a time. If there is a sequence of commands you use often, such as a start-up procedure, combine all those commands into a macro file for easy, one-step operation. See how to build and use macros in the Macro Section.

In the following command descriptions of time and latitude/ longitude, either a colon (:), space, or forward slash (/) may be used to separate the parts of time (*i.e.* mm:dd:yyyy etc.), or latitude/longitude (*i.e.* ddd/mm/ss.sss). For ease of operation, the forward slash (/) only requires one keystroke. The colon requires two keystrokes. Parts of commands shown on the display screen will appear with a colon (:) between each part.

ah
Altitude Hold Enable/Disable

Function	Disables or enables the Altitude Hold command.
Syntax	Disables or enables the Altitude Hold command. **ah ([d | e])** *d* disable *e* enable
Example	**ah e<ENTER>**
Notes	Enabling the **Altitude Hold Enable or Disable** command forces the receiver to use the entered **Altitude Hold Fixed Height** command rather than the calculated altitude. When **Altitude Hold Enable** or **Disable** command is disabled, the receiver uses the calculated altitude.
See Also	**ahp** Altitude Hold Fixed Height
Binary Equivalent	The binary command/data message is: @@Av

ahp
Altitude Hold Fixed Height

Function	Sets the fixed altitude value used when Altitude Hold Fixed Height is enabled.
Syntax	**ahp (hhhhh.hh [gps | msl])** *hhhhh.hh* –1000.00 to 18000.00 meters *gps* GPS ellipsoid height *msl* MSL height
Example	**ahp 350.98 msl<ENTER>**
Notes	Enter the fixed altitude value used when **Altitude Hold Fixed Height** is enabled. The altitude height is specified in meters to a resolution of .01 meter. The entered altitude is referenced to GPS ellipsoid height (height above the reference ellipsoid) or MSL height (height above mean sea level).
See Also	**ah** Altitude Hold Enable or Disable
Binary Equivalent	The binary command/data message is: @@Au

alert (6 channel)
alert8 (8 channel)
Alert Planning Input-Output Message

Function	Computes satellite visibility information for locations other than the ONCORE Receiver's current location.
Syntax	**alert mm dd yy hh:mm [+ | –] hh:mm lat lon hgt mask** (6-channel) **alert8 mm dd yy hh:mm [+ | –] hh:mm lat lon hgt mask** (8-channel)
Example	**alert 11 22 93 13:45 –7:00 33 27 54.208 –111 54 8.406 350 10<ENTER>**
Notes	The receiver requires date, time, GMT time correction, and angle of satellite mask. To create the alert table, use the record alt and run commands for varying times and recording the receiver alert-planning output to a file.
See Also	**latSet** Latitude **lonSet** Longitude **gmtSet** GMT Correction **maskSet** Satellite Mask Angle **timeSet** Time
Binary Equivalents	The binary command/data message is: @@Cd (6-channel) The binary command/data message is: @@Fd (8-channel)

align
Send output alignment

Function	Will align all receiver periodic outputs with the top of the minute.
Syntax	**align ([d | e])** *d* disable *e* enable
Example	**align e<ENTER>**
Notes	The periodic output rates which can be aligned are 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, and 60.
See Also	None
Binary Equivalent	The binary command/data message is: @@AE

alm
Almanac Status Message

Function	Outputs current almanac status information contained within the ONCORE Receiver.
Syntax	**alm ([0 | 1])** *0* output once *1* output upon change
Example	**alm 0<ENTER>**
Notes	Outputs almanac status information corresponding to the currently used satellite almanac data (in RAM), as well as the almanac data currently stored in receiver nonvolatile memory (EEPROM). Press F3 to view the Almanac Status Screen.
See Also	**almhold** Almanac Update-No Update Mode
Binary Equivalent	The binary command/data message is: @@Bd

almhold
Almanac Update-No Update Mode

Function	Controls update of the ONCORE Receiver's almanac.
Syntax	**almhold ([u | n]j)** *u* automatic update *n* no automatic update
Example	**almhold u<ENTER>**
Notes	Controls the automatic update of the ONCORE receiver's internal almanac when a new one is received in the satellite message. Enable the automatic update mode when setting other almanac functions to "output upon change."
See Also	**alm** Almanac Status Message Mode
Binary Equivalent	The binary command/data message is: @@An

almin
Input Almanac Data Message

Function	Manually enters an almanac data message into the ONCORE Receiver.
Syntax	**almin (subframe page byte1, byte2..byte 34)**
Example	**almin.....<ENTER>**
Notes	Inputs an almanac to the ONCORE receiver. The almanac consists of 34 subframe or page messages. A better method of inputting an almanac is to use the **run xxxxxxxx.alm** command to output an almanac stored in a receiver file by the Almanac Data output Message and Record GPS Data commands.
See Also	**almout** Almanac Data Output Message **record** Record GPS Data
Binary Equivalent	The binary command/data message is: @@Cb

almout
Output Almanac Data Message

Function	Outputs current almanac data contained within the ONCORE Receiver.
Syntax	**almout ([0 | 1])** *0* output once *1* output upon change
Example	**almout 0<ENTER>**
Notes	The ONCORE receiver outputs the almanac as thirty-four 33-byte messages. Running the command **Record Alm-Record GPS Data** prior to the **Almanac Data Output Message** command stores data in Motorola Binary Format in a file with extension "alm". Use the **run** command to input the stored almanac data to a receiver. **Press F4 to view Almanac Screen.**
See Also	**almin** Input Almanac Data Message **record** Record Almanac - Record GPS Data
Binary Equivalent	The binary command/data message is: @@Be

aptype
Set Application Type

Function	Sets the type of application: air, hand held, land, marine, or static.
Syntax	**aptype ([a | h | l | m | s])** *a* air *h* hand held *l* land *m* marine *s* static
Example	**aptype a<ENTER>**
Notes	None
See Also	None
Binary Equivalent	The binary command/data message is: **@@AB**

cid
Controller id

Function	Displays the controller copyright and version/revision information.
Syntax	**cid**
Example	**cid<ENTER>**
Notes	None
See Also	None
Binary Equivalent	None

corin
Input Pseudorange correction

Function	Provides a method to manually enter pseudorange corrections.
Syntax	**corin time 1[svid ps psr iode][6 | 8]**
	time — GPS time reference –0.0..604799.9 seconds
	svid — Satellite ID–0..37
	ps — pseudorange corrections –1,048,576..+1,048,576 0.01 meter resolution
	psr — –4,096..+4,096; 0.001 M/S resolution
	iode — issue of data ephemeris 0..25
	1 and 6 or *8* — indicates data is entered once for each of the six or eight satellites
Example	corin 123456.7 03 1234567.89 – 1.234 321 <ENTER>
Notes	Entering pseudorange corrections is done from a file previously created using the **Output Pseudorange Correction** and **Record GPS Data** commands or by feeding the **Output Pseudorange Correction** message from one ONCORE receiver (differential master side) directly to the input of a second ONCORE receiver (slave).
See Also	**corout** Output Pseudorange correction
Binary Equivalent	The binary command/data message is: @@Ce

corout
Output Pseudorange correction

Function	Requests the ONCORE receiver to output the pseudorange correction message for use in a real-time differential system.
Syntax	**corout** ([0 | 1 ..255]) *rate = seconds*
Example	corout5<ENTER>
Notes	**Press F7 to view Pseudorange Correction Data screen.** **corout 0** will update and display pseudorange correction data to the screen once.
See Also	**corin** Input Pseudorange correction
Binary Equivalent	The binary command/data message is: @@Bh

corthr
Send Correction Thresholds

Function	Controls the threshold for smoothness of position fix and differential correction output.
Syntax	**corthr ([f | d])** *f* - FIX_THR 0..127 secs *d* - OUT_THR 0..127 secs
Example	**corthr 0 32<ENTER>**
Notes	The default values are: FIX_THR=0 OUT_THR=32
See Also	None
Binary Equivalent	The binary command/data message is: **@@AD**

date
Change Date

Function	Changes the current data in the ONCORE receiver. If there is not date specified, this command requests the receiver to download the current date.
Syntax	**date (mm/dd/yy or mm/dd/yyyy)**
Example	**8/13/1993<ENTER>**
Notes	The ONCORE receiver ignores the change of date command if the receiver is in the position fix mode with at least one satellite acquired. Range of years is 1980 to 2079.
See Also	None
Binary Equivalent	The binary command/data message is: **@@Ac**

datum
Datum id Code

Function	This command allows you to select which datum the ONCORE receiver uses in performing PVT calculations.
Syntax	**datum (id#)** *predefined* 1...49 *user defined* 50...51
Example	**datum 49<ENTER>**
Notes	All predefined datum's are referenced by ID number (1 through 49). User defined datum's are referenced by ID number (50..51). Refer to Appendix A for list of Datums.
See Also	**udatum** Set User Defined Datum
Binary Equivalent	The binary command/data message is: **@@Ao**

default
Set to Default

Function	Sets all the ONCORE receiver parameters to the factory default values.
Syntax	**default**
Example	**default<ENTER>**
Notes	*IMPORTANT: Upon executing this command, the current almanac loaded in RAM is automatically deleted.* Before using this command, make sure you have made backkup copies (on a separate diskette) of your own almanac file and/or the almanac file that was provided with the receiver. The almanac must then be reloaded after using the **default** command. The time and date stored in the internal real-time clock is *not* changed by the **default** command.
See Also	None
Binary Equivalent	The binary command/data message is: @@Cf

dop (6 channel)
dp8 (8 channel)
xDOP Table Status Message

Function	Sends xDOP parameters, corresponding to combinations of currently visible satellites, to the DOP Table Status screen. The x in xDOP denotes the type of DOP available for a user to select: PARAM DEFINITION GDOP Geometric Dilution of Precision PDOP Position Dilution of Precision HDOP Horizontal Dilution of Precision VDOP Vertical Dilution of Precision TDOP Time Dilution of Precision
Syntax	**dop** ([0 | 1]) (6-channel) **dp8** ([0 | 1]) (8-channel) *0* send once *1* output upon change
Example	**dop 1<ENTER>**
Notes	All data based on the latest satellite visibility calculation. **Press F2 to view DOP Table Status screen.**
See Also	None
Binary Equivalents	The binary command/data message is: @@Bc (6-channel) The binary command/data message is: @@Ec (8-channel)

dopmask
No Position Fix
XDOP Threshold

Function	Sets the xDOP threshold below which the ONCORE receiver will switch from Altitude Hold (2D) positioning to No Position Fix (OD) mode.
Syntax	**dopmask (dd.d)** *1.0...99.9*
Example	**dopmask 12.3<ENTER>**
Notes	None
See Also	**dopthr** 3D to 2D xDOP Threshold
Binary Equivalent	The binary command/data message is: @@Ac

dophys
xDOP Hystersis

Function	This command changes the criteria that selects satellites to use to calculate position, velocity and time.
Syntax	**dophys (dd.d)** *1.0 to 99.9*
Example	**dophys 25.6 <ENTER>**
Notes	In xDOP, this command sets the threshold of change to a given level that has to be exceeded to allow the ONCORE receiver to select a different set of satellites.
See Also	**dopmask** No Position Fix xDOP Threshold **dopthr** 3D to 2D xDOP Threshold
Binary Equivalent	The binary command/data message is: @@Ak

dopthr
xDOP Type

Function	Sets the xDOP threshold below the level where the receiver will switch from 3D positioning to altitude-hold (2D) positioning.
Syntax	**dopthr (dd.d)** *1.0 to 99.9*
Example	**dopthr 25.6 <ENTER>**
Notes	None
See Also	**dopmask** 2D to 0D xDOP Threshold
Binary Equivalent	The binary command/data message is: @@Al

doptype
xDOP Type

Function	This command selects the xDOP type the ONCORE receiver uses for its satellite selection criteria.
Syntax	doptype ([GDOP | PDOP | HDOP | VDOP | TDOP])
Example	doptype pdop <ENTER>
Notes	None
See Also	None
Binary Equivalent	The binary command/data message is: @@Aj

dos
DOS Shell

Function	This command temporarily exits the controller to execute a DOS command.
Syntax	dos
Example	dos<ENTER>
Notes	Only relative to controller. To return to the controller, type: exit<ENTER>
See Also	None

dto
Differential Correction Time-Out

Function	Changes the differential correction time-out at which, if no corrections are received, the receiver switches to autonomous mode.
Syntax	dto ([5..180]) *5..180 seconds* range of time-out
Example	dto 10<ENTER>
Notes	None
See Also	None
Binary Equivalent	The binary command/data message is: @@AJ

ephhold
Ephemeris Hold Enable/Disable

Function	Directs the ONCORE receiver to acquire and use the latest ephemeris data or to use the current ephemeris data in memory.
Syntax	ephhold ([0 | 1]) *0* disable *1* enable
Example	ephhold 0<ENTER>
Notes	Disabling directs the ONCORE receiver to acquire the latest ephemeris data set. Enabling directs the ONCORE receiver to use the current ephemeris data in memory.
See Also	None
Binary Equivalent	The binary command/data message is: @@AA

ephin
Ephemeris Data Input Message

Function	Directs the ONCORE receiver to input an ephemeris data set from one satellite at a time. The entire ephemeris data set is input by using the Run command.
Syntax	**ephin svid byte1 byte2..byte73**
Example	**ephin 3<ENTER>**
Notes	Use the Run command with an .eph extension to input the entire latest ephemeris data set in one step.
See Also	**ephout** Ephemris Data Output Message
Binary Equivalent	The binary command/data message is: @@Bf

ephout
Ephemeris Data Output Message

Function	Directs the ONCORE receiver to output the current satellite ephemeris data.
Syntax	**ephout** ([0 | 1]) *0* send one time *1* output upon change
Example	**ephout 0<ENTER>**
Notes	Invoking the command **Record Eph** command prior to the **Ephemeris Data Output Message** command stores the ephemeris data to a file in the Motorola Binary format in a file with an **.eph** extension. **Press F5 to view Ephemeris Data Screen.**
See Also	**ephin** Ephemeris Data Input Message
Binary Equivalent	The binary command/data message is: @@Bi

epoch
Ephemeris Data Input Message

Function	This command sends the new measurement epoch until this parameter is changed again..
Syntax	**epocht** ([0..999]) *0.000 to 0.999 seconds*
Example	**epoch 1<ENTER>**
Notes	The corrected time reference is relative to either GPS or UTC time, as specified and set by the user via the Time Correction.
See Also	**Change Current Measurement Epoch Offset Option**
Binary Equivalent	The binary command/data message is: @@Ax

ext (6 channel)
et8 (8 channel)
Request Extension Message

Function	Contains extension data of output message.
Syntax	ext ([0 | 1...255]) (6-channel) et8 ([0 | 1...255]) (8-channel) *0* output when polled *1...255* number of seconds between response messages
Example	**ext 1**
Notes	Extension data can be received either at the same rate as POSITION/STATUS/DATA MESSAGE or at a slower rate that can be entered (From 1..255 seconds between response messages).
See Also	None
Binary Equivalents	The binary command/data message is: @@Bk (6-channel) The binary command/data message is: @@Ek (8-channel)

fix
Position Fix Algorithm Type

Function	Directs the ONCORE receiver to use either the best four satellites or all satellites in view for position calculations.
Syntax	**fix ([b | n])** *b* best 4 satellites *n* n satellites in view
Example	**fix n<ENTER>**
Notes	None
See Also	None
BinaryEquivalent	The binary command/data message is: @@Ar

gmt
GMT Correction

Function	Changes the correction factor between GMT and local time.
Syntax	**gmt ((–)hh:mm)** *(–)* for west of Greenwich, England time zone correction. *( )* for east of Greenwich, England time zone correction *hh* hours *mm* minutes
Example	**gmt –07:00<ENTER>**
Notes	None
See Also	None
BinaryEquivalent	The binary command/data message is: @@Ab

hgt
Height

Function	Sets the initial height coordinate of the ONCORE receiver.
Syntax	**hgt ((–)hhhhh.hh [gps | msl])**
Example	**hgt 351.23 gps<ENTER>**
Notes	The ONCORE receiver must not be computing a fix or replacing the current height with the input height while in the position fix mode. Changing the height while the receiver is performing position calculations, causes unpredictable results to occur.
See Also	None
BinaryEquivalent	The binary command/data message is: @@Af

id
Output Receiver Version Information

Function	Commands the ONCORE receiver to output an ID message containing receiver copyright and version or revision information.
Syntax	**id**
Example	**id<ENTER>**
Notes	To view the ID message, turn off (or slow down) the POSITION STATUS/DATA MESSAGE output response
See Also	**pos** Position Status/Data Message
Binary Equivalent	The binary command/data message is: @@Cj

ignore
Satellite Ignore List

Function	Deletes particular satellites by ID number from the ONCORE receiver selection process.
Syntax	**ignore (1[svid#]N)**
Example	**ignore 3<ENTER>**
Notes	Issuing this command the first time ignores the selected ONCORE receiver. To restore that receiver, issue the same command again.
See Also	None
Binary Equivalent	The binary command/data message is: **@@Am**

ioformat
Select I/O Format

Function	Selects either Motorola Binary, NMEA-0183 or LORAN Emulation as the I/O Format.
Syntax	**ioformat ([0 | 1 | 2])** *0* Motorola Binary Format *1* NMEA-0183 Format 2 LORAN Emulation Format
Example	**ioformat 1<ENTER>**
Notes	The GPS Receiver configures the RS232 port parameters (baud rate, start bits, stop bits, etc.) to the selected format.
See Also	None
Binary Equivalent	The binary command/data message is: **@@Ci**

ion
Ionosphere Correction
Disable/Enable

Function	Sets the GPS ionospheric correction model to on or off.
Syntax	**ion ([d | e])** *d* disable *e* enable
Example	**ion d<ENTER>**
Notes	This correction reduces the range error induced by the Earth's ionosphere.
See Also	None
Binary Equivalent	The binary command/data message is: **@@Aq**

lat
Latitude

Function	Sets the initial latitude coordinate of the ONCORE receiver.
Syntax	**lat ((–)dd mm ss.sss)**
Example	**lat –33:27:54.207<ENTER>**
Notes	The ONCORE receiver must not be computing a fix or be in the position fix mode and in the process of replacing the current latitude with new data. The LAT<ENTER> command will give you your current latitude if you are in position fix mode.
See Also	**lon** Longitude
Binary Equivalent	The binary command/data message is: **@@Ad**

leapsec
Status of UTC Leap Second Correction

Function	Sends message of status of leap second correction to UTC at end of month.
Syntax	**leapsec** *m* mode *0* output response message once
Example	**leapsec 0<ENTER>**
Notes	This is a polled-only output message. If a correction is pending, the direction of the correction is indicated.
See Also	None
Binary Equivalent	The binary command/data message is: **@@Bj**

lon
Longitude

Function	Sets the initial longitude coordinate of the ONCORE receiver.
Syntax	**lon ((–)ddd mm ss.sss)**
Example	**lon –111:54:08.444<ENTER>**
Notes	The ONCORE receiver must not be computing a fix or be in the position fix mode and in the process of replacing the current longitude with new data. The LON<ENTER> command will give you your current longitude if you are in position fix mode.
See Also	**lat** Latitude
Binary Equivalents	The binary command/data message is: **@@Ae**

mask
Satellite Mask Angle

Function	Controls the minimum elevation angle at which the ONCORE receiver tracks satellites.
Syntax	**mask (dd)** *mask angle range dd(0...89 degrees)*
Example	**mask 12<ENTER>**
Notes	The elevation angle at which satellite tracking occurs is (0..89 degrees with a **default of 10 degrees)**
See Also	None
Binary Equivalent	The binary command/data message is: @@Ag

mode
Position Idle/Fix Mode Option

Function	Forces the ONCORE receiver to the Idle or Position Fix mode
Syntax	**mode ([i | f])** *i* idle position mode *f* fixed position mode
Example	**mode f<ENTER>**
Notes	The tasks of acquiring and tracking satellites as well as computing position are part of the ONCORE receiver's normal mode of operation (Position Fix Mode). When the receiver is in the idle mode, the processor does not calculate position information and the current drain of power is reduced.
See Also	None
Binary Equivalent	The binary command/data message is: @@Cg

ph
Position-Hold Disable/Enable

Function	Manually turns the position-hold function on and off.
Syntax	**ph ([d | e])** *d* disable *e* enable
Example	**ph d<ENTER>**
Notes	None
See Also	**php** Position-Hold Position
Binary Equivalent	The binary command/data message is: @@At

php
Position-Hold Position

Function	Inputs the coordinate of the position to be held for the ONCORE receiver.
Syntax	**php (lat lon hgt [gps | msl])** *position* lat+ or – dd or mm or ss.sss lon+ or – ddd or mm or ss.sss *height* ±or –mmmmm.mm *height type* 0 GPS ellipsoid height 1 mean sea level reference
Example	**php 33 27 54.207 -111 54 08.444 350.000 0 <ENTER>**
Notes	The ability to specify receiver coordinates is required for applications such as timing and real-time differential master stations. This command is used in conjunction with the position-hold enable or disable command to provide the means of manually turning the position-hold position function on or off.
See Also	**ph** Position-Hold Enable/Disable
Binary Equivalent	The binary command/data message is: @@As

pos (6 channel)
ps8 (8 channel)
Position Status/Data Message

Function	Outputs the position or channel status or data message
Syntax	**pos ([0 | 1...255]) (6-channel)** **ps8 ([0 | 1...255]) (8-channel)** *output rate in seconds* *0* one time only *1..255* rate of message repetition (in seconds)
Example	**pos 1<ENTER>** *or* **ps8 0<ENTER>**
Notes	You have the option of requesting data output one time (0) or at a specified rate of one time very 1 to 255 seconds.
See Also	None
Binary Equivalents	The binary command/data message is: @@Ba (6-channel) The binary command/data message is: @@Ea (8-channel)

ppsdelay
1PPS Cable Delay

Function	Instructs the ONCORE receiver to output the 1PPS output pulse earlier in time to compensate for antenna cable delay.
Syntax	**ppsdealy ([0.0...0.000999999])**
Example	**ppsdelay .000000051<ENTER>**
Notes	Delay is in seconds.
See Also	None
Binary Equivalent	The binary command/data message is: @@Az

quit
Exit to DOS

Function	Closes all open files, saves the current reference point, closes the program, and exits to DOS.
Syntax	**quit**
Example	**quit<ENTER>**
Notes	Only relative to controller.
See Also	None

record
Record GPS Data

Function	This computer-specific command causes the opening and closing of files for storing data.
Syntax	**record [pos | alm | eph | rng | cor | evt | bin | ps8 | rg8 | et8 | ext | alt | alt8 | trs | ts8] (c)**
Example	**record bin<ENTER>**
Notes	Only relative to controller. The file is opened by using the **record** command and files type. The file is closed by repeating the **record** command and files type followed by a "c" or by invoking **quit** command, which closes all open files. All data stored in the files is stored in either comma-separated variable (CSV) format, Motorola Binary format, or ASCII text, depending on the file type. The **bin** option indicates a desire to store all data received in binary format. This command opens or closes the file. It does not invoke the command requesting the required data.
See Also	None
Binary Equivalent	None

refpt
Set Reference Point

Function	Enters a reference point or a waypoint to be used by the position, status, or data message interpretation routines to calculate north, east, and vertical offsets between the receiver-calculated position and this known reference position.
Syntax	**refpt** ([lat lon hgt])
Example	**refpt** 33:27:54.207 –111:54:08.444 350.00<ENTER>
Notes	These offsets are displayed as part of the position, channel, or status display.
See Also	**pos** Position/Channel/Status message

rng (6 channel)
rg8 (8 channel)
Satellite Range Data Output Message

Function	Outputs basic satellite range and range-rate information for each of the satellites that the ONCORE receiver is tracking.
Syntax	**rng** ([0 | 1..255]) (6-channel) **rg8** ([0 | 1..255]) (8-channel) *0* one time only *1..255 seconds* rate of message repetition
Example	**rng** 5<ENTER>
Notes	You have the option of selecting data output one time (0) or a repeated output at a user-specified rate (1..255 seconds). **Press F6 to view Satellite Range Data screen.**
See Also	None
Binary Equivalents	The binary command/data message is: @@Bg (6-channel) The binary command/data message is: @@Eg (8-channel)

run
Run Command

Function	This is a computer specific command that inputs the contents of the specified file instead of accepting input from the keyboard.
Syntax	**run** [filename]
Example	**run testfile.dta**<ENTER>
Notes	Only relative to controller. The commands in the file can be either in an ASCII version of the Motorola Binary format without the checksum, carriage return, and line feed at the end of the command, or in the command and parameters format described by this document. **Press F8 to view Self-Test Data screen.**

selftest (6 channel)
selftest8 (8 channel)
Self-Test Command Response

Function	Causes the receiver to perform a self-test.
Syntax	selftest selftest8
Example	selftest<ENTER>
Notes	None
See Also	None
Binary	The binary command/data message is: @@Ca (6-channel)
Equivalents	The binary command/data message is: @@Fa (8-channel)

sm
Satellite Select Mode Automatic/ Manual

Function	Selects either automatic or manual satellite selection mode.
Syntax	sm (a | m | h) *a* automatic mode *m* manual mode *h* highest-in-sky mode
Example	sm m<ENTER>
Notes	In automatic mode, the ONCORE receiver selects the satellites based on the best geometry and will change satellites to maintain the best geometry. In manual mode, the ONCORE receiver tracks the satellites previously selected but allows you to change the satellites using the command. In highest-in-sky mode, the ONCORE receiver selects the highest four, six, or eight satellites. The number of satellites selected depends on the Position Fix Algorithm Type.
See Also	ss Manual Satellite Select fix Position Fix Algorithm Type
Binary Equivalent	The binary command/data message is: @@Ah

ss
Manual Satellite Select Control

Function	Manually assigns a satellite to a specific receiver channel.
Syntax	ss (chan svid)
Example	ss 1 3<ENTER>
Notes	This command is valid if the ONCORE receiver is in the Manual Satellite Select mode.
See Also	None
Binary Equivalent	The binary command/data message is: @@Ai

time
Local Time of Day

Function	Changes the current time of day in the receiver or if there is no time specified, requests the receiver to output the current time.
Syntax	**time (hh:mm:ss)** *h* hours *m* minutes *s* seconds
Example	**time 23:23:23<ENTER>**
Notes	If the ONCORE receiver is in the Position Fix mode and has acquired at least one satellite, it ignores a change of time command and outputs the current satellite based time. The receiver output time is either GMT time or local time. This output time is dependent on the setting of the GMT correction parameter.
See Also	None
Binary Equivalent	The binary command/data message is: **@@Aa**

trstat (6 channel)
trstat8 (8 channel)

Output Time RAIM Setup and Status

Function	This command provides dual functionality. First, it allows the user to input the Time RAIM setup configuration. Second, it outputs the Time RAIM setup and status information. The setup information configures the Time RAIM algorithm with the user defined parameters. The status portion informs the user of the state of the algorithm and outputs the fractional portion of the GPS local time estimate for each of the satellites being tracked.
Syntax	**trstat (mrate, enable, alarm, mode, prate, date, time)** **trstat8 (mrate, enable, alarm, mode, prate, date, time)** *mrate* [0 I 1...255] *enable* [0 I 1] *alarm* [3...65535] *mode* [0...3] *prate* [0...86400] *date* (mm/dd/yy *or* mm/dd/yyyy) *time* (hh:mm:ss)
Example	**trstat 1 1 3 1 1 9/23/99 12:30:15<ENTER>**
Notes	You have the option of outputting the data one time only or a repeated output at a user-specified rate of up to 255 seconds. **Press <shift> F4 to view Time RAIM Setup and Status Screen.**
See Also	utc UTC Time Correction Command
Binary Equivalents	The binary command/data message is: @@Bn (6-channel) The binary command/data message is: @@En (8-channel)

udatum
Set User-Defined Datum

Function	Defines the two user-defined datum's stored in Datum ID numbers 50 and 51.
Syntax	**udatum (id sma if dx dy dz)** *id* 50 51 *sma* semi major axis *if* inverse flattening constant *dx* delta x *dy* delta y *dz* delta z
Example	**udatum 50 6378206.4 294.9786982 –7 162 188<ENTER>**
Notes	Defines the constants used for a custom datum: semi major axis inverse flattening constant delta–x delta–y delta–z
See Also	None
Binary Equivalent	The binary command/data message is: **@@Ap**

UTC
UTC Time Correction Enable/Disable

Function	References the time sent as part of the position/status/ Data output message to GPS or UTC time. With Option I enabled, this command allows independent referencing of the one PPS pulse to GPS time, UTC time, or the measurement epoch.
Syntax	**utc ([d | e]([g | u | m]))** *d* disable (GPS time) *e* enable (UTC time) *g* GPS time *u* UTC time *m* measurement_epoch
Example	**utc e m<ENTER>**
Notes	The satellite 1PPS output signal is referenced in the ONCORE receiver to UTC or GPS time based on this command if Option I is not enabled.
See Also	None
Binary Equivalent	The binary command/data message is: **@@Aw**

vis
Visible Satellite Status Message

Function	Outputs the results of the most current satellite alert computation.
Syntax	vis ([0 | 1]) *0* displays output one time only *1* outputs when visibility changes
Example	vis 1<ENTER>
Notes	This message gives summary of the satellite visibility status. **Press F1 to view the Visible Satellite Status Screen.**
See Also	None
Binary Equivalent	The binary command/data message is: @@Bb

Glossary

A

ALM	Almanac

B

C

D

DCE	Data Communication Equipment
DFLT	Default
DGPS	Differential GPS Operation
DOP	Dilution of Precision

E

EPH	Ephemeris
EPROM	Electronically Programmable Read Only Memory

F

G

GDOP	Geometric Dilution of Precision
GMT	Greenwich Mean Time (See Universal Time Coordinated)
GPS	Ground Positioning System
GPS DFLT	Ground Positioning System Default
GPS ICD-200	The GPS Interface Control Document

H

HDOP	Horizontal Dilution of Precision
HGT	Height
HDG	Heading

I

J

K

L

Lat	Latitude
Lon	Longitude
LORAN	Long Range Navigation

M

MSL	Mean Sea Level

N

NMEA	National Marine Electronics
NAD-83	Association North American Datum, 1983.

O

P

PDOP	Position Dilution of Precision
PR	Pseudo Range
PRC	Pseudo Range Correction
PRN	Pseudo Random Noise
PRR	Pseudo Range Rate
PRRC	Pseudo Range Rate Correction

Q

R

RAM	Random Access Memory
RDOP	Relative Dilution of Position
REFPT	Reference Point
RNG	Range
RT	Route

S

SA	Selective Availability
SPD	Speed
SS	Signal Strength
SV	Satellite Vehicle/Space Vehicle
SVID	Satellite Vehicle Identification

T

TDOP	Time Dilution of Precision
TOA	Time of Almanac
TOW	Time Of Week
TTFF	Time To First Fix

U

UTC	Universal Time Coordinated
UTM Map	Universal Transverse Mercator Projection

V

VDOP	Vertical Dilution of Precision

W

WNA	Week Number of Almanac (Start date is Jan. 06, 1980. Restart after week number 500)

X

Y

Z

Engineering Notes

EMC (ElectroMagnetic compatibility Considerations

RF Shielding

The RF circuitry sections on the ONCORE GPS receiver board are protected with a tin plate shield to guard against potential interference from external sources. When designing the ONCORE near and around RF sources such as radios, it is recommended that the ONCORE be tested and tried in the target environment to identify potential interference issues prior to final design.

NOTE: The GPS ONCORE receiver contains a very sensitive RF receiver, you must observe certain precautions to prevent possible interference from the host system. Because the Electromagnetic environment will vary for each OEM applications, it is not possible to define exact guidelines to assure electromagnetic compatibility.

RTC (Real Time Clock)

If there is no Lithium battery option, the receiver will start up but will have an incorrect time unless it was previously set and maintained by an external battery. To ensure a faster time to first fix, the time, date and GMT offset should be reset if both the main power and battery backup power have been disconnected.

Note that if the Lithium battery option is on-board, then the receiver clock is set to UTC time prior to shipping and maintained by the on-board Lithium battery automatically.

1PPS Signal Definition

- 0 to 5 V live pulse
- 1 PPS time mark is synchronous with rising edge of pulse. Rising from 0 V to 5 V.
- Rise time approximately 20 to 30 nanoseconds
- 5 V pulse width is approx. 200 milliseconds ± 1 millisecond
- The falling edge will occur approximately 200 milliseconds after the rising edge.

Accuracy:

- 300 to 500 nanoseconds in stand alone mode
- 100 nanoseconds in DGPS mode

TTL Serial Interface

The serial interface signals, RXD and TXD, are available for user connection. A ground signal is also required to complete the serial interface. There is no additional protection and signal conditioning besides the internal protection of the micro. These signals are coming from the microprocessor directly. They are regular TTL signals with voltage ranges from 0 to 5V. For input signals, minimum input high voltage is 2.0V and the maximum input high voltage is 5V. Minimum input low voltage is 0V and the maximum input low voltage is 0.8V. For output signals, minimum output high voltage is 2.4V and the maximum output low voltage is 0.5V.

This interface is not a conventional RS-232 interface that can connect to a PC (which is normally equipped with RS-232 interface) directly. An RS-232 driver/receiver is required to make this connection. The driver/receiver provides a voltage shift from 0 to 5V to a positive and negative voltage (for example, ±10V), and also has an inversion process in it. Some RS232 driver/receiver ICs (Integrated Circuits)—for example; Motorola's MC145407—will provide all these functions with only a +5V supply.

TTL

TTL	0V to 0.8V	= logic "0"
	2.4V to 5.0V	= logic "1"=
RS-232	-5V to -15V	= logic "1"
	5V to 15V	= logic "0"

Note: 50pf maximum capacitance on TTL level output

RS-232	-5V to -15V	= logic "1"
	5V to 15V	= logic "0"

Datum

DATUM ID	LOCAL GEODETIC SYSTEM	ELLIPSOID	DX	DY	DZ
1	ARC_1950	Clarke_1880	-143.0	-90.0	-294.0
2	ARC_1960	Clarke_1880	-160.0	-8.0	-300.0
3	AUSTRALIAN_ GEODETIC_1966	Australian_National	-133.0	-48.0	+148.0
4	AUSTRALIAN_ GEODETIC_1984	Australian_National	-134.0	-48.0	+149.0
5	BOGOTA_OBSERVATORY	International	+307.0	+304.0	-318.0
6	CAMPO_INCHAUSPE	International	-148.0	+136.0	+90.0
7	CAPE	Clarke_1880	-136.0	-108.0	-292.0
8	CARTHAGE	Clarke_1880	-263.0	+6.0	+431.0
9	CHATHAM_1971	International	+175.0	-38.0	+113.0
10	CHUA_ASTRO	International	-134.0	+229.0	-29.
11	CORREGO_ALLEGRE	International	-206.0	+172.0	-6.0
12	EUROPEAN_1950_WestEurope	International	-87.0	-96.0	-120.0
13	EUROPEAN_1950_CYPRUS	International	-104.0	-101.0	-140.0
14	EUROPEAN_1950_EGYPT	International	-130.0	-117.0	-151.0
15	EUROPEAN_1950_IRAN	International	-117.0	-132.0	-164.0
16	EUROPEAN_1950_SICILY	International	-97.0	-88.0	-135.0
17	EUROPEAN_1979	International	-86.0	-98.0	-119.0
18	GANDAJIKA_BASE	International	-133.0	-321.0	+50.0
19	GEODETIC_DATUM_1949	International	+84.0	-22.0	+209.0
20	HJORSEY_1955	International	-73.0	+46.0	-86.0
21	INDIAN (Thailand/Vietnam)	Everest	+214.0	+836.0	+303.0
22	INDIAN(Bngldsh/India/Nepal)	Everest	+289.0	+734.0	+257.0
23	IRELAND_1965	Airy_Modified	+506.0	-122.0	+611.0
24	KERTAU_1948	Everest_modified	-11.0	+851.0	+5.0
25	LIBERIA_1964	Clarke_1880	-90.0	+40.0	+88.0
26	LUZON	Clarke_1866	-133.0	-77.0	-51.0
27	MASSAWA	Bessel_1841	+639.0	+405.0	+60.0
28	MERCHICH	Clarke_1880	+31.0	+146.0	+47.0
29	MINNA	Clarke_1880	-92.0	-93.0	+122.0
30	NAHRWAN	Clarke_1880	-247.0	-148.0	+369.0
31	NORTH_AMERICAN_1927_CONUS	Clarke_1866	-8.0	+160.0	+176.0
32	NORTH_AMERICAN_1927_ALASKA	Clarke_1866	-5.0	+135.0	+172.0
33	NORTH_AMERICAN_1927_CANADA	Clarke_1866	-10.0	+158.0	+187.
34	NORTH_AMERICAN_1927_C_AMER	Clarke_1866	-0.0	+125.0	+194.0
35	NORTH_AMERICAN_1983	GRS-80	-0.0	-0.0	0.0
36	OLD_EGYPTIAN	Helmert_1906	-130.0	+110.0	-13.0
37	OLD_HAWAIIAN	Clarke_1866	+61.0	-285.0	-181.0
38	OMAN	Clarke_1880	-346.0	-1.0	+224.0
39	ORD_SRVY_GRT_ BRITAIN_1936	Airy	+375.0	-111.0	+431.0
40	PITCAIRN_ASTRO_1967	International	+185.0	+165.0	+42.0
41	QUATAR_NATIONAL	International	-128.0	-283.0	+22.0
42	QORNOQ	International	+164.0	+138.0	-189.0
43	SCHWARZECK	Bessel_1841_in_Nambia	+616.0	+97.0	-251.0
44	SOUTH_AMERICA_1969	South_America_1969	-57.0	+1.0	-41.0
45	TIMBALAI_1948	Everest	-689.0	+691.0	-46.0
46	TOKYO	Bessel_1841	-128.0	+481.0	+664.0
47	ZANDERIJ	International	-265.0	+120.0	-358.0
48	WGS-1972	WGS-72	-0.0	-0.0	+4.5
49	WGS-1984	WGS-84	-0.0	-0.0	0.0